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ARCTIC PROBLEMS.*

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The geographical system of the north polar regions has been gradually made known by piecing together the information brought home to us by a long succession of explorers. Forty years ago, when Sherard Osborn and I began to work for the renewal of arctic research, the discovery of the unknown coasts east and west of the northern end of the channel leading from Smith Sound appeared, from our point of view, to be the next piece of work to be done. The English Expedition of 1875 did this thoroughly for a distance of 300 miles. Every branch of science was enriched by its labours; and the character of the ice in the northern ocean was carefully studied. There is tremendous pressure on that coast; yet the small size of many of the floes, and the numerous hummocky ridges, showed that the ice was in motion during the summer. The expedition of 1875 did its work so exhaustively that there was nothing more to be done up Smith Sound, except the completion of the tracing of the north coast of Greenland. That great mass of land was known to be an island from a study of the tides in 1875–76, and the work done in the journey of Sir Lewis Beaumont has been continued by Lockwood and Peary. There, however, still remains a wide gap before the discovery is completed to Cape Bismarck on the east coast.

* The map on p. 483 is little more than a rough diagram, intended to give an approximate idea of the ground covered by the expedition, and the position of the newly discovered lands.

The expedition of 1875 threw a new light on the whole polar question. The extraordinary character of the floe-bergs and of the ancient ice on that northern coast, led us to compare it with the similar ice described by Collinson, McClure, and McClintock along the coasts of North America, Banks Island, and Prince Patrick Island. It seemed to indicate continuous ice-pressure along the western side of the Arctic Regions from Bering Strait to the east coast of Greenland, and a consequent flow over a great ocean from the eastern to the western side. There were, however, several gaps to be filled up and many researches to be made before the full meaning of the knowledge then in our possession could be explained.

In my note on the results of the Arctic Expedition of 1875, written in the following year, I had already come to the conclusion that there was a deep sea, and not land, to the north of Franz Josef Land; that there was a continuous drift across the Arctic Regions from east to west, and, consequently, heavy ice-pressure on the western side.

All this was confirmed by Nansen in his great discovery of the polar ocean. After his voyage there is no longer any geographical object in going to the north pole, except for the sake of deep-sea soundings, for it is merely a point in the polar ocean, the economy of which has been made known by Nansen. That great explorer finally removed the veil which concealed the secret of the Arctic Regions. There is no insuperable difficulty in reaching the pole with an able leader and a proper system. It is not to be compared to the work of McClintock and Mecham; but there is no sufficient object.

The really useful work that remained, so as to connect the whole western side of the arctic regions, is (1) the discovery of the region between the Asiatic Coast and Prince Patrick Island; (2) the examination of the space from Prince Patrick Island to the furthest point reached by Admiral Aldrich during the expedition of 1875; and (3) the completion of the tracing of the northern coast of Greenland.

The first piece of work is the most difficult, and it may well be that the region in question contains no land, and is merely part of the polar ocean. The third would be a great and important achievement. Captain Sverdrup intended to attempt it by wintering in a hut on the north coast of Greenland, and sending the *Fram* round to meet him at Cape Bismarck. This is the only way in which it can be done; but two ships would be safer. Prevented by the unfavourable season in 1899, Captain Sverdrup fortunately turned his attention to Jones Sound, which led to the completion of the most important remaining

Preliminary sketch
showing
CAPT. O. SVERDRUP'S EXPLORATIONS
1898 to 1902
Scale of Miles
0 50 100 200 300
Nat. scale 1:10,000,000 or 158 miles = 1 inch
Coastline explored by members of Capt. O. Sverdrup's
expedn shown in a thick line.
Routes
GREENLAND
ELLESMERE LAND
NORTH DEVON
BAFFIN BAY
PARRY ISLANDS
MELVILLE I.
BANKS LAND
BEAUFORT SEA
M'CLURE STRAIT
MELVILLE SOUND
Smith Sound
Jones Sound
Lancaster Sound
Penny Str.
Wellington Chan.
Byam Chan.
Austin Chan.
Byam Martin Chan.
Erskine Inlet
Barrow Str.
Winter Harbour
Beechey I.
Byam Martin I.
Melville I.
Prince Patrick I.
Lands End
C. Manning
Croziers Chair.
Juliet Str.
C. Wrottesley
C. Alfred
Melville I.
C. M'Clintock
Findlay I.
Eglinton I.
Grinnell Land
Queen Chan.
Cornwallis I.
Bathurst I.
Cameron I.
Lougheed I.
Ellef Ringnes I.
Amund Ringnes I.
Meighen I.
Axel Heiberg I.
Ellesmere I.
Grant Land
Lady Franklin Bay
Kennedy Chan.
Robeson Chan.
C. Columbia
C. Sabine
C. Hawks
C. Clarence
C. York
Alexandra Fiord
Sverdrup Harbour
Aldrich Harbour
Fortress Rock
Lat. 79°-30'N.
Lon. 108° W.
Winter Quarters
Lat. 78°-35'N.
Lon. 103° W.
Cape Sparbo
Cape Isachsen
Cape Thomas Hubbard
Cape Colan
Cape Belcher
Cape Columbia
Cape Colgate
Cape Fanshawe
Cape Lawrence
Cape Hardy
Cape Herschel
Cape Norton Shaw
Cape Prescott
Cape Providence
Cape Walker
Cape Parry
Cape Grinnell
Cape Hotham
Cape Spencer
Cape Dalhousie
Cape Garry
Cape Young
Cape Dyer
Cape Searle
Cape Wilberforce
Cape Faraday
Cape Crozier
Cape Colborne
Cape Bowen
Cape Walsingham
Cape Back
Cape Kellett
Cape Lyon
Cape Providence
Cape Parry
Cape Grinnell
Cape Hotham
Cape Spencer
Cape Dalhousie
Cape Garry
Cape Young
Cape Dyer
Cape Searle
Cape Wilberforce
Cape Faraday
Cape Crozier
Cape Colborne
Cape Bowen
Cape Walsingham
Cape Back
Cape Kellett
Cape Lyon

arctic work of all, namely, the discovery of what was hitherto unknown in the wide gap between Prince Patrick Island and Aldrich's furthest.

The whole of the northern coasts of the Parry Islands were discovered by the naval officers employed on the Franklin searches, from Jones Sound to Prince Patrick Island. But, except at the western extreme of these discoveries, the ice-pressure was not very great, and it was supposed that there must be land further north. Indeed, at the eastern end Sir E. Belcher sighted land far to the north, which he named North Cornwall; and from Bathurst Island land was sighted to the north, and named Findlay. Aldrich's furthest is some 250 miles to the north of Belcher's discoveries. The great arctic work to be done, by way of Jones Sound, was to decide these questions, to discover the western side of Ellesmere Island, and to discover the land, if it existed, to the north of the Parry Islands. In this way our knowledge of the long line of coasts facing the frozen ocean on the west side of the Arctic Regions would be made complete.

This great work has been done by Captain Sverdrup and his gallant companions during four travelling seasons entailing four arctic winters, and it has been done thoroughly. They have discovered the western side of Ellesmere Island and its intricate system of fiords, as well as three large islands west of Ellesmere Island; they have explored the northern coast of North Devon; they have connected Belcher's work with the coasts of Jones Sound; they have reached a point within 60 miles of Aldrich's furthest; and they have discovered that land north of the Parry Islands the existence of which was conjectured, as far west as the longitude of the eastern coast of Melville Island. This includes the discovery of the northern sides of North Cornwall and Findlay Island. In addition to the main arctic problem which is thus solved, it is likely that the region discovered will be of exceptional interest, from the winds and currents, the varying character of the ice, the existence of coal-beds, and the abundance of animal-life. A systematic survey has been made of these important discoveries, checked by astronomical observations. We must look forward to an account of these things, and to the details of the expedition, with the deepest interest; and meanwhile we may well express admiration for the way in which the work was conceived and executed, and at the perfect harmony with which all loyally worked under their chief. Without such harmonious work success was not possible.

THE UPPER CONGO AS A WATERWAY.*

By the Rev. GEORGE GRENFELL, B.M.S.

UNTIL a quarter of a century ago people little dreamed of the existence of the great Central African waterway which now furnishes a practicable route half across the continent; and when Mr. Stanley (now Sir Henry M. Stanley) discovered this magnificent natural canal of 1000 miles in length, he little thought that the affluents flowing into it from the north and from the east and from the south would increase the available waterway to beyond 6000 miles. Neither could he, nor those who were so interested in his great discovery, have ventured to imagine that by the end of the century that had already entered upon its last quarter, more than a hundred steamers would have been launched upon those waters in the interests of commerce and civilization.

The cataracts that bar the navigation of the Congo at a point 100 miles up-stream from the coast, and that are more or less continuous for some 200 miles, have sufficed from the days of Diogo Cão right down to our own times, to daunt every explorer who from the Atlantic has tried to solve the mystery of the upper river, and it was only to the intrepid traveller from the Indian ocean that it at length yielded up its secret. Even the navigable lower river, accessible though it was from the sea, was but little known, and was practically unused as a route to the interior, the greater portion of the upper Congo trade finding its way to the coast by the long overland route to Loango, Ambriz, and St. Paul de Loanda. So late as 1874, when Lieut. Grandy started eastward in search of Dr. Livingstone, he left the coast at a point some distance south of the mouth of the river, and struck away inland without utilizing the waterway.

Till 1879, two years after Stanley's discovery was made known, steamers rarely made their way up the lower Congo beyond Boma, and then, with the exception of a small gunboat at long intervals, these were all coasters of but light tonnage. In fact, sometimes for periods of three months together, Boma would be entirely dependent upon canoes and small sailing craft for its communication with the coast. In no case, however, did these small steamers go beyond Noki; but to-day it is by no means unusual to see four ocean liners, ranging up to five thousand tons, at Matadi, the port at the foot of the cataracts whence the railway sets out on its track to Stanley pool, and after some 220 miles reaches the smooth water of the upper river. Matadi is at the farthest limit of navigation on the lower river, some 8 miles beyond Noki, and, instead of being the bare rock it was a few years ago, is now,

* Notes to accompany the Rev. George Grenfell's map of the Congo river. Map, p. 572. Three sheets of the map are given in the present number; the other two sheets will accompany the December *Journal*.

after much blasting, the site of one of the most important ports on the west coast of Africa.

At the other end of the railway, where, after rounding the cataracts, it reaches the navigable upper river, is the port of Leopoldville, the next most important place in the Congo State to the capital at Boma. Brazzaville, the administrative centre of the French on the upper Congo, is on the other side of the river about 3 miles away. These places were unknown native villages twenty-five years ago, but since that time have witnessed great developments, and have become the starting-points for a fleet of more than a hundred steamers that have been carried in plates and sections beyond the cataracts, and reconstructed there. These steamers are of all sizes, from small open launches up to crafts carrying between 200 and 300 tons.

Steamers on the Upper Congo.

The first steamer to reach the great Central African waterway was the *En Avant*, a small paddle-boat 43 feet long and 8 feet in the beam. It was carried up in three sections on waggons, and reached Leopoldville in November, 1881, after a couple of years of very arduous labour on the part of Mr. Stanley and his lieutenant, and the continuous employment of several hundred carriers and workmen.

The next steamer to arrive came a year later. It was a 30-feet mahogany launch, and was carried up on a single waggon. It had seen service as a tender to one of King Leopold's yachts, and was placed at Mr. Stanley's service by his Majesty—a beautiful little craft, but one that proved too frail for the trying conditions of upper Congo service.

This was followed by the French steamer *Ballay*, a steel launch larger than the mahogany one just referred to, but smaller than the *En Avant*. It was brought by way of the Ogowe, and after steaming as far as possible up that river, its boilers and engines were dismounted, and its empty hull hauled through the shallower waters of the upper reaches. Later, when it could be no longer borne by the waters of the Ogowe, it was dragged across the narrow watershed dividing that river from the Alima. The waters of the Alima being reached, the hull was refloated, and, deeper water being gained, the machinery was replaced, enabling her, under steam, to reach the main stream of the Congo at a point some 250 miles above the cataracts, and about 550 miles from the coast.

The labour involved in the transport of each of these three steamers was so great, that when the fourth was decided upon, it was arranged to send out the prepared materials, plates, and parts of machinery, and to put them together at Stanley pool, where the upper navigable river commences. The experiment was an eminently successful one, and it was proved that a great deal more was gained by transporting a steamer in small pieces, such as could be carried on men's shoulders, than was

involved by the cost of reconstruction. This steamer, the *Association Internationale Africaine* (named after the organization under whose auspices it was sent out), was about the size of the *En Avant*, but had a screw propeller instead of paddles; it was completed early in 1883.

The next boat to be launched on the Congo was the *Peace*, sent out by the Baptist Missionary Society of Great Britain. Designs were prepared for her early in 1882, but it was not till December that she was ready for shipment. Transport and reconstruction occupied just a year and a half, and allowed of her being launched in June of 1884. In this case the idea of subdivision was carried out so thoroughly by Messrs. Thornycroft, the builders, that no single piece of the hull, or boiler, or machinery was of greater weight than the tusks of ivory the native carriers were accustomed to carry from the interior down to the coast. She was a twin screw boat, 70 feet long and 10 feet 6 inches wide, drawing only a foot of water, and was the first craft to which the since famous Thornycroft tubulous boiler was fitted. She is still running, and rendering very efficient service.

During the first two years after being launched she carried those in charge of her along 2000 miles of the upper Congo affluents, previously unvisited by any white man, and it was during this time that the preliminary lines of the map of the main stream now published were laid down. The details of the islands, and of the many channels, have since been filled in as opportunity has offered during a succession of journeys up and down river.

While the *Peace* was being reconstructed at Stanley Pool, the Belgian Association was engaged in the task of transporting the first stern-wheel steamer, *Le Stanley*, to the upper river. She was a boat 80 feet long by 16 feet beam, built by Yarrow on their widely adopted system of floatable sections, a system that allows of the structure being bolted together as its various sections float on the surface of the water, and the steamer to be completed without the help of a slipway or a dock. The separate sections of this craft were 16 feet by 10 feet by 4 feet deep, and each one had its own iron-wheeled waggon. The difficulties encountered in hauling these waggons over the hills were so great that, although during the following fourteen years some forty more steamers were carried round the cataracts, this system was not again resorted to till the railway made the transport of heavy sections a simple matter. Only one departure from the plan of sending up prepared and fitted plates was resorted to, and this was in the case of the *Ville de Bruxelles*, a pitchpine boat, 80 feet by 18 feet, which was sent up in the shape of planks and timbers. In this case the cost of transport was also very heavy, and the durability of wood proved to be so far inferior to that of steel plates as hardly to enter into competition therewith. The experience gained in the case of the mahogany boat, and later with this pitchpine one, was clearly against building

with wood. By this time, also, experience was just as clearly in favour of stern-wheels as propellers. Stern-wheels, however, are heavy, and involve heavy machinery difficult and costly to transport, and only the Government and the larger commercial enterprises could face the problem of organizing the needful caravans for anything but a comparatively small boat of this type. The Congo Inland Mission managed to get their 70-feet boat through in 1884; but one of the American missions, after spending a considerable sum in carrying a larger boat part of the way round the cataracts, had to abandon the task, and to pay a further considerable sum to have it carried back to the foot of the cataracts. Here this boat was eventually reconstructed and sold, and it has since remained on the lower river.

Since the completion of the railway in 1898, the upper Congo fleet has been more than doubled in number, and has been increased to several times its previous capacity. Till the railway provided for the transport of heavy machinery, steamers were practically limited to a maximum capacity of 60 tons. With the help of the railway, steamers of 200 to 300 tons have been launched at Leopoldville, and this without a tithe of the effort and stress previously involved by the transport of a steamer one-fifth the size.

The stern-wheel system has simplicity and ready access to machinery as prominent advantages, though it is not so economical as the ordinary screw-propeller. The smaller boats are also inclined to be top-heavy, and small and large alike have as little of the "ship-shape" about them as any floating craft can well possess—a 2-lb. biscuit tin with a long funnel at one end and a sort of water-wheel at the other would make a model doing but little injustice to the majority of Congo stern-wheelers.

The Government is trying experiments with a series of lighters of from 70 to 300 tons, and powerful tug-boats capable of towing them at moderate speed; but up to the present opinion is somewhat divided as to the advantages of the system. Theoretically there is much in favour of it, but the difficulties of navigation caused by currents and counter-currents of the narrower reaches of the river are greatly increased when the power and the load are in separate vessels.

The reconstruction of steamers and boats sent out in comparatively large sections, as so many have been since the completion of the railway, is a much simpler task than when plates have to be riveted together one by one, and the structure gradually built up. It has the disadvantage, however, of involving much heavier cost for ocean freight, and of not being so strong, for the joints between the sections are continuous lines from keel to deck, across the deck, and down to the keel again, whereas in the case of plates the joints are "lapped" like those in the boarding of a well-laid floor. The disadvantage in this latter respect was strongly emphasized last year during a trial trip

by the giving way of one of these long lines of joints, and the termination of the steamer's career. As I came down river last time I saw her upper works just above water, some 2 miles or so out of the dock where she had been put together.

Considering the many risks encountered by steamers on the upper Congo and its affluents, the list of total losses is not so great as one might expect. The losses would have been much greater but for the careful way in which most of the boats are subdivided into watertight compartments. These subdivisions are not only important as confining the area to which water is admitted in case of a plate being "stove in," but because they greatly stiffen the long shallow hulls, and enable them to stand the severe and variable stresses consequent upon the unequal distribution of load on the structure generally. These "stresses" in the case of stern-wheelers are peculiarly severe, seeing the heavy boiler is at one end and the machinery at the other, and just where, in each case, the buoyancy is least. To counteract the tendency in these boats to rise amidship and to drop at the bow and stern, posts and tie-rods are introduced in all but the smaller ones; but notwithstanding these measures, it is very unusual to see a stern-wheel steamer that preserves her original lines for more than the first few months of service. However, though many of the Congo steamers are only built of very light plate and become more or less hump-backed, they are so tied and braced together that they carry their heavy loads wonderfully well. It is no unusual thing to see them laden till they have less than a foot of freeboard, and, in places where the river is rough, to see the water rolling pretty continuously across the decks. Where hatches are well fastened down this is not a very serious contingency perhaps, but, caught in bad places, two 10-ton boats with large deck-openings filled and went down in deep water. Two other steamers of nearly the same size have also been totally lost by having been carried over cataracts. The strong currents setting off projecting reefs, and the counter-currents and whirlpools forming below them, have been responsible for the loss of two 20-ton stern-wheelers. This class of boat, if it carries any considerable structure on the awning above the main deck, is peculiarly liable to top-heaviness. In both the cases now referred to the steamers capsized, and, after floating down stream a short distance, finally disappeared in deep water.

Dangers of Navigation.

Long reefs of rocks jutting out into the stream, and sometimes occurring as isolated patches in the middle of the river, render the first 150 miles or so of the upper Congo beyond Leopoldville particularly dangerous. They have so far, however, caused but two total losses, though they have involved very heavy expenditure for repairs to many boats. Reefs jutting out from the bank are generally indicated by

their shoreward ends presenting themselves to view, and by the ripple they cause upon the surface of the water; but isolated reefs and rocks are sometimes found in the quiet places below projecting points, where there is no current at all, or perhaps a slight counter-current, and these are the most dangerous of all the obstacles to Congo navigation. A 40-ton steamer was wrecked on one of these projecting reefs, but her cargo and much of her machinery was saved; and the *Courbet*, sister craft of the *Faidherbe* that was carried across the watershed dividing the Congo from the Nile to figure in the "Fashoda affair," was lost by striking one of these isolated masses of rock in comparatively still water. She struck it with sufficient force to tear open several plates and to pass over into deep water beyond, where, some four or five minutes later, she sank, as the *Victoria* sank, bow first, and her propeller still revolving in the air as her stern disappeared from view.

Next to the rocks in importance among the dangers of Congo navigation one must rank the "snags." They cause as many accidents as the rocks, but happily not such serious ones. As the Congo and its affluents with their more than four thousand islands furnish at least 20,000 miles of overhanging wooded banks, the number of trees which fall annually into the water is very considerable. Many of these are of greater specific gravity than water, and lie just where they fall; the lighter ones float for awhile, but becoming waterlogged they sink to the bottom. Those that sink in deep water are no menace, but those that lie where during the fall of the river they come within a few feet of the surface are a constant source of danger.

Steamers drawing more than 3 feet of water incur greatly increased risks, because snags and rocks below that depth give little or no evidence on the surface of their existence below. During the low-water season steamers drawing more than 4 feet of water are navigated with considerable difficulty, by reason of the innumerable sandbanks which encumber the channels. This is especially the case on downward journeys, much time being frequently lost in pushing or in warping off. If the steamer draws 3 feet or so, the crew can generally solve the difficulty in a little while by jumping into the water and pushing in the required direction, two or three of them being occupied the meanwhile in searching for deeper water, and, having found it, they form into a line of living buoys, indicating the best route across a shallow patch. If mere pushing is not enough, the anchors of shallow boats can easily be carried out into 4 or 5 feet of water and the winch be brought into requisition for the work of warping off. But when the boat draws 4 feet or more, anchors have to be carried out by means of boats or canoes, and warping off becomes an especially wearisome operation. Stern-wheelers can cope much more speedily with the difficulties furnished by sandbanks than is the case with screw-propellers. If a stern-wheeler sits down on a sandbank, it is mostly a matter of

keeping the engines going astern for a time, and the violent wash caused by the paddles will excavate a channel; the screw-propeller, on the other hand, simply excavates a deep hole immediately under the stern, while at the same time it drives a lot of sand into the stern tube bushings, and grinds the shaft and bearings away in a fashion that is simply terrible from the engineers' point of view.

The reason why down-stream journeys are more seriously delayed by sandbanks than those in the opposite direction is due to the fact that the banks gradually shelve upwards till their highest ridges are reached at the down-stream ends, and steamers, after being driven up the sloping bank a certain distance by virtue of their own speed, are driven on still further by the force of the descending current. On the other hand, a steamer going up-stream strikes a sandbank with its own proper force reduced by that of the current instead of increased thereby, and, as a sandbank generally presents a steep face on its down-stream side, the steamer either cuts through the crest or is pulled up sharp before it is seriously embedded.

Upon regarding a map of the Congo between the 15th and 25th meridians, one remarks that the river follows a course indicated by wide curves and comparatively right lines that contrast very markedly with the serpentine courses of so many rivers. However, if the banks of the river are not traced in the characteristic sharp curves of inland waters, the main volume of the river and the strong currents undoubtedly follow very sinuous lines. Where the river-banks are comparatively close, say from $\frac{3}{4}$ mile to $1\frac{1}{2}$ mile apart, the water setting over from one side to the other creates below the point of deflection a counter-current, where banks of sand and mud are deposited, and, upon impinging upon the other side, the water is again deflected and another counter-current set up, to be followed by the formation of other banks. Thus the course of the main volume of water is very tortuous, though, except at very low water, when the banks show above the surface, the fact is apparent only to those who are personally interested in navigating its course. Where the river widens out, as it does in many places, to more than 5 miles, and even to 6 or 7, and where it winds its way among islands and round sand-banks, the waters, instead of maintaining themselves at a depth of several fathoms, are reduced to as many feet or even less. Spread over so wide an area, they become sluggish, and much of the sand with which they have been charged, picked up in the higher reaches by the swifter stream, is deposited in the shape of a long series of fan-tail banks, over the extended edges of which the water glides with its very characteristic ripple into the suddenly deepened channel on the down-stream side, and this, in many cases, without affording a passage for even a shallow-draught steamer. If such a bank is to be passed at all, it is at the extremity on the opposite side from which its formation

commenced, but very often the deeper water to be looked for between the point of the sandbank and the shore is so narrow or is so overhung by trees as to be impracticable, and then another channel has to be sought among the islands. As there are nearly eighty islands between 5 and 10 miles in length, and fifty more than 10 miles (one is nearly 50 and two are more than 30 miles long), getting out of one channel into another is sometimes a serious contingency involving a long *détour*.

Navigation of the Congo.

The navigable upper Congo commences at Leopoldville, situated at the head of the cataracts, and at the point where the railway round the cataracts has its terminus. From Leopoldville to Stanleyville, at the foot of the Stanley falls, a distance of 980 miles, navigation is uninterrupted all the year round. The government wharf and the railway terminus are within 200 or 300 yards of the ledge of rocks over which the river makes the first of a long series of drops on its way to Matadi, a series with a total of 700 feet.

On leaving Leopoldville and proceeding up-stream, one has the French Congo on the left hand for a distance of 330 miles, as far as the confluence of the Mobangi, along the course of which stream the boundary turns northward. From this point the Congo Independent State holds both banks of the main stream.

Brazzaville, the capital of the French Congo, is about 4 miles beyond Leopoldville and the cataracts, and, of course, is on the other side of the river. The entrance to Stanley pool is about 3 miles beyond Leopoldville, and the river thus far is from 1 to 1¼ mile in width. On the Brazzaville side the cliffs are 100 feet or more in height; on the Congo state side the banks are not so bold, but are even more rocky. As, besides the rocks on either side, there are several detached reefs right out in the stream, navigation is very dangerous—so dangerous, in fact, that from time to time the question of making a new port some 6 or 7 miles beyond has been seriously entertained. At Kalina point the full force of the Congo is encountered, and rounding it into Stanley pool is often a difficult matter. The downward current, as it rushes out of the pool, sets off the point with such force as to make a strong up-current for a quarter of a mile below on the landward side. Taking advantage of this current on going up-stream is always fraught with the risk of being swept completely round as one enters the down current, unless the matter is negotiated in the most careful manner. Captains always breathe more freely when Kalina point is behind them.

Stanley pool is an expanse of water and islands and sandbanks some 20 miles in length by 14 miles in breadth, but though Kalina point has been passed on entering it, the difficulties of navigation are not at an end; the south-west corner of the pool bristles with rocks till Kinshasha

is well astern. Then, as soon as the rocks are passed, one is in the midst of the difficulties furnished by the sandbanks deposited by the river as it spreads itself out and becomes too sluggish to hold the sand any longer in suspension. The difficulties presented by sandbanks would not be so great if, like the rocks, they but stayed in the places where one found them. The channel of this season may be dry bank the next, and soon be covered with grass and scrub, but only perhaps to disappear a little later at the rate of some hundreds of cubic yards per minute as it is undermined by the current, which has once more been deflected towards its previous course. Sometimes a disappearing sandbank, while it goes to build up an obstacle at some other point, leaves a positive danger in the shape of a reef of rocks which it had previously very effectively masked.

Beyond the pool the channel for 125 miles is confined between steep-faced hills on either side. From bank to bank the distance ranges from 1 to 2 miles; it is frequently less than 1 mile, very seldom as much as 2. The hills rise to 800 feet above the river for some distance from the pool, but at 100 miles beyond they are seldom much more than half that height, are much less steep, and begin to recede from the water's edge. The height of the river above the sea is a little more than 800 feet. For the first 30 miles the course is eastward; then, after passing the Black river, it turns sharply to the north. At a point 85 miles beyond the pool the Kasai joins the Congo, pouring its immense volume into it at a right angle through a deeply cut chasm in the rocky hills some 700 yards in width. Through this gap in the hills steamers have access to the series of waterways furnished by the Kasai and its tributaries, amounting to not less than 1500 miles. When the Kasai is in flood its current in the centre is from 5 to 6 miles an hour, and it brings down such an amount of bright brick-red water as to greatly modify the dark brown of the stream which gradually absorbs it.

About 40 miles north of Kwa mouth (the Kasai confluence), the "Chenal," as it is called, terminates; the hills have so receded that the river spreads itself out to a width of 5 miles, the rocky ledges and reefs, the spurs sent out into the river by the hills on both sides, and that have been a continual menace since leaving the pool, have given place to sandbanks, and rocks are hardly seen again for 500 miles. This expansion continues northwards for 30 miles; it is very shallow, and its farther end is characterized by many islands. On the slightly rising ground at its northern extremity, the Bolobo villages are found, and just beyond, after narrowing to less than 2 miles, the channel expands again to a width of 5 or 6 miles—the width it practically maintains as far as Lukolela, a distance of 100 miles. Midway along this reach the Alima pours its water into the Congo from the west, and the delta it forms extends itself into the main stream till the width becomes a little less than 4 miles. It is at this point alone, throughout

the length of this reach, that both banks of the river are in sight of each other, the long lines of islands elsewhere obscuring the view. On the same side of the river, and some 30 miles beyond the Alima, is the principal mouth of the Sanga, a very important tributary that furnishes an available waterway for steamers right up to the south-eastern corner of the German Cameroons colony.

The Lukolela narrows are some 5 miles in length, and are formed by a range of low hills of ferruginous conglomerate, running north and south, through which the river makes its way. Twenty miles beyond, and after widening out again to 5 miles, there are more narrows and more ferruginous conglomerate, though it does not rise more than 30 or 40 feet above the river. Beyond the Butunu narrows, the river widens to 7 miles, but in less than 25 miles the conglomerate upon which Liranga and Ngombe are built reduce the river once more to less than a couple of miles. Liranga is at the south-western limit of the delta formed by the confluence of the Mobangi with the main stream, and from this point the French boundary trends northwards, following the "thalweg" of the Mobangi instead of that of the Congo. The Mobangi is navigable as far as Zongo, a distance of 350 miles, and there are several important reaches beyond that are available for the small steamers taken beyond the various rocky barriers at propitious moments of the river's flood. It was by this river and its affluent the Mbomu that the *Faidherbe* made its way, to be eventually carried across into the Bahr el Ghazal province. It is by this river, also, that the French expeditions towards Lake Chad find their most advantageous route from the south.

Beyond the Liranga-Ngombe narrows there are 170 miles of the Congo's course before, at a point just below Bangala, it is reduced to 2½ miles from bank to bank. So persistently do the islands block the view, that throughout the whole length of this long reach there are very few places where one bank is observable from the other. The Juapa, the Ikelemba, and the Lulongo rivers pour their inky waters into this reach within the first 40 miles north of the equator, and, after commingling with the Congo, very perceptibly darkens its hue. These important eastern tributaries furnish more than 1000 miles of navigable waterway, but they mostly traverse very low-lying country.

Between the Bangala narrows and Bopoto, where once more the river is perceptibly reduced in width, there is a distance of 175 miles. Where this reach includes the 50-mile island of Nsumba, the river widens to 9 miles. The only important tributary received in this reach is the Mongala, from the north-east, a river navigable for more than 300 miles, and traversing one of the best rubber-producing fields of the Congo State. Bopoto is situated almost at the extreme north of the great "Horseshoe bend" (in 2° 7' N. lat.), and on the flank of the first semblance of a hill for more than 400 miles after passing Lukolela.

After so long a stretch of low flat land, it is quite refreshing to see a hill, even though it is barely 200 feet in height; to the natives who have not previously seen anything bigger than an anthill, such an altitude is quite impressive, and to the younger people even awe-inspiring. Here one comes into contact with the felspathic bed rock of the central part of the continent, and for 10 miles or so navigation becomes a very serious matter because of the dangers incident upon the presence of reefs. It is the same rock over which the Congo drops at Stanley falls, and over which it drops again below Stanley pool.

The next narrows are 100 miles beyond Bopoto, and about 10 miles above the mouth of the Loika, or Itimbiri river; apparently they are caused by the deposits brought down by that river. The Loika is navigable by steamers for 150 miles, as far as the Lubi falls, and is the route by which the Congo Government transport leave the Congo for the Lado enclave on the Nile.

At a distance of 105 miles beyond the Lubi narrows, and just beyond the mouth of the Aruwimi, the Congo is reduced to a mile in width, and beyond that point largely loses its lacustrine characteristics. A change announces itself on the southern bank some 30 miles before reaching Basoko (the centre of administration at the mouth of the Aruwimi river), by the reappearance of rocks and of low hills, and by the time one is opposite Basoko the hills have become pretty continuous, and rise to nearly 200 feet in height. On the north bank, the high land does not commence till one is 15 miles east of the Aruwimi, beyond that point it is nearly continuous till Stanley falls are reached. On the southern bank, however, the hills soon give place to a narrow ridge of clay and gravel bank slightly above flood-level, with a wide extent of swampy land to the interior. The distance between Basoko and Stanley falls is 130 miles, but at a point a little less than halfway, the Lomami, coming from the south, empties into the Congo the waters it has gathered along a course of more than 700 miles; it is navigable for more than 200 miles. If the Congo is markedly less in size above the Aruwimi, it is even more markedly reduced beyond the point where it receives the Lomami, and the islands become very few. At 20 miles beyond the Lomami the channel is once more bounded by steep and often rocky banks of from half a mile to a mile apart. During the low-water season the navigation of the last 20 miles below Stanleyville becomes somewhat dangerous, because of the reefs of rocks that at that time lie so close to the surface. Boats drawing more than 3 feet of water find this part of the river impracticable during the dead low water that sometimes obtains at the autumnal equinox, but happily this only lasts for a week or two, and at all other times boats drawing from 4 to 4½ feet can, with caution, navigate the whole of the 980 miles from the pool to the falls.

Flood Seasons.

On the upper Congo each year is characterized by two flood seasons, May and November, prolonged respectively in some places till June and December. The maximum rise in the upper reaches towards Stanley falls is about 8 feet at both these dates. At Stanley pool the rise in May is not so great, but in November and December it is nearly twice as much.

In January and February the water is falling everywhere over the Congo system. The Mobangi has commenced to fall in October, and by this time is near its minimum. At Stanleyville the water commences to fall early in December, but at Stanley pool the maximum is at times not reached till the close of the month. During the month of January the fall is very rapid, and by the end of the month the river is very low. In April there is a very general rise, and the Loika and the Aruwimi approach their high-water marks. By May the Congo waters are so much higher than those of the Mobangi that there is a flow of Congo water into the Mobangi through the Ibenga channel and flowing northwards to 24′ 30″ south of the equator. The same thing occurs in the Ekenzi and Bwaiya channels communicating with the Sanga; they serve, according to the relative heights of the waters of the Sanga and the Congo, as outlets or inlets.

As there are two high-water seasons, so also are there two seasons of low water, the second occurring in August and September; and at some points these are the months of the lowest water of all the year. Along the farther half of the upper river the rising and falling of the water is more capricious than further down stream, changes of 2 or 3 feet occurring in a day or so without persisting. At Bolobo and the pool the rising and falling are most regular; the rise seldom exceeds 2 inches per day, and the fall is rarely more than 3 inches in a similar period. This greater regularity is doubtless due to the fact that the inundated plains, thousands of square miles in extent, which are under water every season, act as storage reservoirs, as Lake Ntumba also does, alternately taking and giving the water as the river rises and falls.

Velocity of Current.

The rate at which the Congo current flows varies very considerably; it seems to depend somewhat upon the height of the river, and to be modified also by the contour of the channel. Generally speaking, the current is faster as one approaches the higher reaches. The fastest currents registered, except at points where exceptionally accelerated, have been in the neighbourhood of Basoko and beyond, and they have ranged from 300 to 350 feet per minute. Near Bopoto, according to season and location, the current ranges from 225 to 270 feet per minute; lower down river the mean may be taken as 200 feet per minute.

Some of the affluents flow at a slower rate, and range from a speed of from 70 to 170 feet. At the point where the Kasai pours through its narrowed channel into the Congo, the current is not less than from 600 to 700 feet per minute at the time of flood—about the same rate as that of the Congo itself as it flows out of the pool round Kalina point.

Fuel for Steamers.

Seeing that railway freight round the cataracts is nearly £40 (forty pounds) per ton, the importation of coal as fuel for steamers is practically impossible. Fortunately, lack of wood, which so hampers steam navigation on the Nile, is unknown on the Congo, as, in the main, the banks of the river and the islands are forested throughout the whole course from Leopoldville to Stanleyville. True, in some reaches there are stretches of grassy foreshore before the forest is accessible, and in some places the forest is very swampy, but it is very seldom indeed that wood is not within reach. Sometimes during the high-water season it has been needful for wood-cutters to work in 2 or 3 feet of water, and even, in places where no foothold could be secured, for them to go out in boats so that they might reach and climb the trees for the purpose of lopping off their branches, after having made fast the ropes by which they were to be drawn on board the steamer for fuel. The increased consumption of wood, by reason of the recent additions to the upper Congo fleet, has made dry wood scarce in some places, but as yet very little cutting of live timber has been needful to keep up the requisite supply of fuel, and the forests are so prolific that even though they had to be thinned out to meet the supply, the thinning could be so arranged as to be of advantage to the timber growth rather than otherwise. So far the dead trees of the forest have met nearly all the demands, and the annual supply of such fuel is immense.

Food Supplies.

The matter of food-supply is not less important than that of fuel. The difficulty in obtaining food from the natives is hardly credible to those who regard the Congo banks as populous and fertile; if they were more populous they could easily be made productive. As things are at present, steamers going down to the Pool have to shorten their stay to the fewest possible days on account of the difficulty experienced in feeding their crews, and after leaving the Pool, nothing or next to nothing is to be obtained for the first 180 miles. The great lack is that of people to cultivate the ground. After carefully counting the houses in the villages on the banks of the river, and allowing a very full average for the inhabitants of each house, it is perfectly clear that there are not more than 125,000 people in the villages and towns along the 980 miles of waterway. The great necessity of the Congo, as of all African colonies, is people for its development. We know there are

many places in the Congo State where the population is much more dense than on the river-banks, but nowhere else are people of such advantage to the Government or to commerce as they would be if settled on the banks of the great central waterway of the continent. A policy which made the river-banks to be more desired by the people than the interior, would best serve the interests of the State, and would help forward at a greatly quickened pace the opening up and civilization of the country.

THE GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOUTH GEORGIA.

By C. SKOTTSBERG, Botanist of the Swedish Antarctic Expedition, 1901–1903.

On April 22, 1902, the Swedish Antarctic Expedition on board the *Antarctic* arrived at South Georgia in order to make an investigation of its natural history. After a visit to the location of the German Expedition in 1882–83, we put up our tents in Cumberland bay, and there I spent nearly two weeks. During this time the land was almost free from snow, so that I was able to investigate the country in spite of the advanced season. From May 17 until June 15 the vessel was anchored in another part of the above-mentioned bay.

Before the German explorers undertook their very extensive examination of South Georgia, our knowledge of that island was very scanty. From the Germans we obtained very full information of the conditions at Royal bay.* The neighbourhood of Cumberland bay was superior to the German location, both as to the extent and the variation of the ground, and it was hoped that our researches might yield results that would supplement what we hitherto knew. In the following paper I give a short summary of the features and the vegetation of South Georgia, keeping details for a future paper.

South Georgia is a very high ridge, rising very steeply out of the ocean. The mountains, in general highly inaccessible, rise to heights of more than 6000 feet. Great masses of ice occupy vast areas; mighty glaciers open out into the fiords, and hanging glaciers are

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* "Botany of the Expedition," published in *Die internationale Polarforschung, 1882–83. Die Deutschen Expeditionen und ihre Ergebnisse.* B. II. Hamburg, 1890.

A. Engler: "Die Phanerogamenflora in Süd-Georgien."
F. Will: "Vegetationsverhältnisse Süd-Georgien."
C. Müller: "Bryologia Austro-Georgiæ."
J. Müller: "Lichenes."
K. Brantl: "Filices."
P. F. Reinsch: "Die Süsswasseralgenflora von Süd-Georgien."
" "Zur Meeresalgenflora von Süd-Georgien."
C. M. Gottsche: "Die Lebermoose Süd-Georgiens."

met with a short distance from the coast. Glacier rivers and brooks from perpetual snow-fields are to be found everywhere, exercising a great influence on the distribution of plants. The lowland occupies a very small area, and is broken by steep ridges into narrow valleys, opening on to a level beach, covered by sand and pebbles. On these shores and in these valleys we find the vegetation of South Georgia. Besides that, the coast is extremely steep, having a very poor vegetation.

I shall only say a few words about the climate of South Georgia. The summers are cold, snow falling even in summer-time. November is the month of spring according to the observations made by Dr. Will. We arrived there during the winter, but even in the beginning of May I found a few flowering plants, though, of course, they were mere exceptions. During our visit the lowest temperature observed was $-11°{\cdot}8$ C.; the lowest noticed by the German station was $-12°{\cdot}5$ C. Owing to the exceedingly strong wind, the climate of South Georgia is a severe one. The prevailing wind is westerly. Much snow falls during the winter; when we left the country the lowland was covered by more than 3 feet of snow.

On the level coast, especially when covered by sand and pebbles, we find the best locality for one of the most remarkable plants of the sub-antarctic regions—the tussock grass, *Poa cæspitosa* (Forst.), Hook. f. The large tufts showed still rather unfaded colours. On favourable places it reaches a height of 3 to 5 feet. Along the beach the tussock is often margined by *Acæna adscendens*, Vahl, that also grows amongst the tussock, when less dense. On the rocky shores the tussock forms a very broken carpet amongst the stones, hanging down from the rocks. Here also a small *Colobanthus** thrives even in the narrowest clefts. *Amphiloma dimorphum*, Müll. Arg., covers the rocks down to high-water mark, visible from a distance by its bright colour.

The tussock vegetation expands from the coast into the glens, clothing also the surrounding mountains to an altitude of 800 to 950 feet. Even the steepest slopes are covered, if not exposed to rockfalls. In South Georgia, as well as in other countries, it keeps pretty near to the coast, and many of the small islets are covered by it.

The tussock grass always avoids moist ground. It ascends the slopes of the hills in well-marked tongues, but between the hills, where it could be more protected from the wind, we always look for it in vain. Where *Poa cæspitosa* does not grow, and where the ground is not too moist, we find the more level parts occupied by meadows, composed of *Phleum alpinum*, L. and *Festuca erecta*, D'Urv., the last perhaps

* According to Engler, l.c., *C. subulatus* (D'Urv.), Hook. f. There seems to me to be a little difference between the South Georgian specimens and those from the Falkland islands which I have collected.

more abundant. Forming dense turfs, the meadows go farther from the coast than the tussock, and also rise to a higher altitude. Besides the above-mentioned plants, *Aira antarctica*, Hook., is an important component, on moister places growing in spots of some square metres. *Acæna adscendens*, Vahl, and *lævigata*, Ait., are also very common. Round the base of the rocks, on moist slopes, etc., *A. adscendens* forms a dense carpet of some few inches in height; in the bottom one sometimes finds a small *Galium*, according to a preliminary determination, *G. antarcticum*, Hook. f. This plant was not observed on South Georgia before.

Mosses and lichens play a very important part in the meadows. Special species of *Polytrichum* are remarkable, forming large, extremely hard knolls. Amongst the lichens we remark *Sphærophorus*, sp., *Sticta Freycinetii*, Del., and *endochrysea*, Del., *Stereocaulon magellanicum*, Th. Fries, *Cladina rangiferina*, Hoffm., *Cladoniæ*, spp., etc.

The boggy ground is inhabited by *Rostkovia magellanica*, Hook. f., easily visible from a distance through its dark brown colour. Amongst the always abundant *Rostkovia* we find, more sparingly, *Juncus Noræ Zelandiæ*, Hook. f.; *Ranunculus biternatus*, Smith; *Acæna adscendens*, and *Aira antarctica*. As the low land between the hills is extremely well irrigated, the *Rostkovia* vegetation occupies large areas in South Georgia. If a stream gets into a tussock vegetation it will very soon transform it, the *Polytrichum* and *Rostkovia* coming in and forcing out the tussock.

Here I will remark that on a very moist place in Cumberland bay I found some spots with abundant *Poa pratensis*, L., not before observed in South Georgia. This plant is very common near all colonized parts of Tierra del Fuego and the Falkland islands. The locality on South Georgia lies close to a harbour that has been several times visited by sealing or whaling ships.

In the close vicinity of the rivulets we find a vegetation, particularly composed of some mosses, growing very luxuriously, especially at the small waterfalls, in which South Georgia is rich. Amongst the moss *Montia fontana*, L. often thrives. *Acæna adscendens* is also very common by the margins of the rivulets. In the bed grow *Callitriche verna*, L. and *Ranunculus biternatus*, always only in vegetative state, but very luxurious.

A rather peculiar flora inhabits the large areas of boulder clay that I got an opportunity to see on South Georgia. It is to be regarded as a poor meadow on stony ground, the phanerogamic plants being scarce. *Festuca erecta*, *Phleum alpinum*, *Aira antarctica*, and both kinds of *Acæna* are to be found. Characteristic of this soil is *Colobanthus crassifolius* (D'Urv.), Hook. f. The cryptogamic plants are more abundant; especially one *Lycopodium*, probably *L. clavatum*, L., var. *magellanicum*, Hook. f. (a Lycopodiacea was not met with before in South Georgia), amongst the mosses a very peculiar *Polytrichum*;

numerous lichens—for instance, *Stereocaulon magellanicum*, *Cladina rangiferina*, *Cetraria*, sp., and *Sticta Freycinetii*. Here and there, where the soil is still more moist, a spot of *Rostkovia* appears.

The higher up we come from the surface of the sea, the more desolate and barren is the land, the more poor the vegetation. Already on the tops of low hills, only about 300 feet high, we see, if the locality is a little windy, nothing but a moor of lichens: *Spherophorus*, sp., *Stereocaulon magellanicum*, *Neuropogon melaxanthus* (Ach.), Nyl., *Sticta Freycinetii*; other species encrust the stones, especially *Rhizocarpon geographicum*. The phanerogams are the same species seen in the meadows, though very scarce.

At an altitude of about 900 feet, we still find meadows on the more favoured slopes, but then they disappear, the individual becoming more dwarfish too. I have gathered *Festuca*, *Phleum*, and *Aira* on an altitude of about 1500 feet; the *Acæna* species does not go so far; *Acæna lævigata* thrives better on the stony places than the other. *Aira antarctica* is perhaps the most hardy of them all; it is the most southern phanerogamic plant known hitherto. South Georgia has no special alpine flora. Two ferns seem to prefer the clefts higher up in the mountains, viz. *Aspidium mohrioides*, Borz. and *Hymenophyllum peltatum*; Desv. *Cystopteris fragilis*, collected in the mountains at Royal bay by Dr. Will, was not met with during our visit.

The well-known *Neuropogon* (*Usnea*) *melaxanthus*, characteristic of the mountains in the sub-antarctic and antarctic regions, is very common here too, but only on sheltered situations it appears in its full strength, forming tufts about $3\frac{1}{2}$ inches high, richly covered with fruit. The colour varies from light sulphur-yellow to dark green or black.

On the higher crests, where the dreadful gales rage without any obstacle, we look in vain for anything but a few barren mosses, or even only some poor lichens encrusting the stones.

In a few words to summarize our knowledge of the South Georgian vegetation and its conditions of life.

South Georgia is an ice-covered highland where the level land has a very subordinate position. On account of that, a richer vegetation inhabits only a small part of the coast region. Of the south-western coast we know very little, mainly that the conditions there are much worse than on the north-western side, of course owing to the complete exposure to the usual direction of wind.*

All slopes towards the north show a much richer vegetation than those towards the south.

The poorness of different species is very great. After our visit we now know fifteen phanerogamic plants and four ferns, all these

* Klutschak, H.: "Ein Besuch auf Süd-Georgien," *Deutsche Rundschau f. Geogr. u. Statistik*, iii. Jahrg. 11 Heft.

also found in other parts of the world. The lichens—twenty-six kinds, eight of which were described as new species,* and especially the mosses (fifty-two Musci † and eleven Hepaticæ ‡) are richer developed. Their number will perhaps become a little enlarged, when my collections are worked out. As for the mosses, it is very remarkable and singular that fifty-one of the fifty-two Musci and seven of the eleven Hepaticæ were described as new species.

As to the vegetation of the sea. *Macrocystis pyrifera*, Ag. forms a band along the coast and fills the shallow bays with its dense masses. Amongst the kelp live a lot of different algæ, both brown, red, and green, some distributed also in other parts of the South Atlantic ocean, and others only inhabiting the sea round South Georgia. Shallow basins on the beach are very common; they are filled up by a beautiful and rich vegetation, and clothed by calcareous algæ. On the rocks *Ulva latissima*, L.* and *Enteromorpha Novæ Hollandiæ*, Kütz.† often live in great masses. Here, as well as in the arctic regions, the vegetation of the sea carries off the palm.

Port Stanley, Falkland Islands, August, 1902.

THE MEDITERRANEAN COAST REGION OF EGYPT.

By Major RYCROFT.

I. The Western Coast-line.

There is no country which apparently ends so abruptly as Egypt, for when once the cultivated portion, which is the land irrigated by the Nile inundation, is passed, the traveller finds himself in what appears to be a limitless extent of absolute desert. This is marked on maps as the Libyan desert, and the actual frontier, where Egypt marches with Tripoli, is a line passing south from a point on the Gulf of Sallum, 320 miles to the west of Alexandria. Although the whole is described as desert, this is hardly a word applicable to the greater part of the actual coast-line, as there is a belt some 15 miles in breadth where, in the winter, a considerable amount of corn—barley, with a little wheat—is grown, the soil being light but good. Along this belt there are numerous wells, and sufficient herbage to sustain considerable flocks of sheep and goats, with a few cattle, horses, and donkeys, in addition to large herds of camels.

In ancient times, *i.e.* in the days of the Ptolemies, there was considerable traffic along this coast, as it was the main route to the temple of Jupiter Ammon, in the Siwa oasis, those going on the pilgrimage either proceeding the whole way by land or going by sea to Marsa Berek, the ancient Kabanadom, or Marsa Matru, the ancient Paroetorium,

* J. Müller, *l.c.* † C. Müller, *l.c.* ‡ C. M. Gottsche, *l.c.*

thence by the desert route. In addition to the pilgrims on the way to consult the oracle, there was a large population, which, judging from the various ruins along the coast, must have lived in substantially built and carefully laid out cities. Whether or no climatic conditions have altered it is hard to say, but it is evident that in old times, as now, water was of great value, for on all the sites of ancient cities or halting-places on the road to the sacred temple are to be found large cisterns hollowed out of the solid limestone rock. These cisterns are numerous and very large, the usual size being 7 yards square by 15 feet deep, giving a capacity of over 40,000 gallons, and the great value attached to them is shown by the massive foundations of walls, by which in most cases they were evidently surrounded and guarded.

The inhabitants of this region are Arabs of the Awlad Ali tribe, who mostly lead a nomadic life, though in places the more wealthy of them inhabit stone-built huts, using in many cases ancient catacombs and cisterns as granaries and storehouses. In October, after the first rain, they commence to plough near the sea, extending their cultivation as the rain recurs, at the same time drifting further from the coast, accompanied by their flocks, which at this season lamb. In March and April they harvest their crops, and drive surplus sheep, camels, etc., towards Alexandria for sale, many of them remaining near Mariut during the heat of summer. These Arabs are all followers of the Senussi, whose representatives reside at the Zoweirs (religious schools), which occur at intervals along the coast. The extent of their influence may be judged from the fact that smoking, an Arab's most cherished habit, has been entirely given up in obedience to the chief's commands. There is but little trade in this area, though in the autumn caravans carry dates from the Siwa Oasis to Egypt chiefly by way of the Wady Derah, while camels, sheep, and goats find their way in the spring to the Behera province of Egypt, and some barley, which is especially valued for malting, is exported to Alexandria. During the summer months numbers of sponge-fishers, chiefly from the Grecian archipelago, sail across to the harbour of Matru and get large quantities of sponges from the neighbouring reefs; while in the autumn a big trade is done in quails, as these birds then arrive in large quantities from the north and, alighting along the coast, are taken by the Bedawin in great numbers. Greek traders form depôts at convenient points, and the quails are taken to Alexandria by sailing-boats, at least one million being forwarded there in a good year.

A few words on the nature of the coast may not be out of place. As a whole it is inhospitable, studded with dangerous reefs, and greatly exposed to the prevailing north-westerly winds. There are, however, good anchorages in the Gulf of Sallum, also to the east of Ras-el-Kenais, which is about midway between Sallum and Alexandria. There are also, principally between Ras Bulau and Ras-el-Kenais, several small

marsas, or harbours, which give good protection for small boats. These marsas are, however, difficult of approach, the entrances being in all cases through narrow and generally shallow openings in the reef, while they are in no way lighted or buoyed. In ancient times, both Marsa Berek and Marsa Matru were important harbours, and an attempt is now being made by the Egyptian Coast Guard Administration to improve the latter. The climate on the whole is delightful, being only really hot for some three months, and even then tempered by sea-breezes, while during the winter months it is fresh and bracing. There is no proper record of the average rainfall, but it is undoubtedly greater than that of Alexandria, which averages about 8 inches per annum.

To those interested in archæological research, a trip through this district would be of the greatest interest, as everywhere one comes across the well-preserved foundations of ancient towns, which should well repay careful investigation.

II. The Eastern Coast-line.

From the Suez canal to Rafah, which, situated 30 miles beyond El Arish, is the actual frontier between Egypt and Palestine, is a distance of 140 miles. The whole is shown on most maps as desert, with a broad belt bordering on the Mediterranean marked as shifting sand-dunes. In former times the route from Salhieh to El Arish *viâ* Kantara was greatly used, and large caravans constantly passed along it, but the now existing sea-transport being cheaper and quicker, there is but little traffic.

Crossing the canal by ferry at Kantara, one enters a scrub-covered plain, which extends for about 16 miles, with a very gentle rise towards the east, when the zone of shifting sands is encountered, and the road at once becomes deep and difficult. These dunes, which in places rise as high as 200 feet, are composed of the finest particles of sand, and under the influence of the prevailing winds, here chiefly from the west, but varying from north-west to south-west, have a tendency to move in an easterly direction. After 9 miles of deep sand, the road for 5 miles crosses a somewhat marshy plain fringed by palm groves. This is the oasis of Gatya, where somewhat brackish water is found, from 6 to 12 feet below the surface, everywhere within a radius of some 20 miles, and very large numbers of date-palms are grown. They are owned by Bedawin, most of whom, however, live the greater part of the year in the Sharkiyeh and Dakahliyeh provinces of Lower Egypt, visiting this part of the desert to collect the dates in August and September. From Gatya the road again enters the region of shifting sands, and passing Bir-el-Abd (16 miles) leads to Bir-el-Maza (32 miles), which is the only water between Bir-el-Abd and brackish wells in the palm groves near El Arish some 26 miles further on. El Arish is a mud-built town with a population of some five thousand, nestling under a small fort $1\frac{1}{2}$ mile

from the sea, and to the west of the Wady Arish, and appears to be threatened by advancing sand-dunes. The usually dry river Arish here enters the sea, and in the valley, which is about $1\frac{1}{2}$ mile broad, are large palm groves and gardens with many wells. The desert from the Suez canal to El Arish is subject to very bad dust-storms, which are much dreaded by the Arabs, and frequently last for several days, as I can testify from my own experience. With the object of ascertaining whether the canal between Port Said and Ismailia can be reached without crossing the zone of shifting dunes, I returned by a more southerly route to Ismailia. South of El Arish the country is chiefly undulating desert sloping upwards towards the south, with a considerable amount of rough grass and low scrub. It is drained by the Wady Arish, which, starting on the high plateau some 150 miles to the south, is generally quite dry, though after rain—an event of rare occurrence—it becomes a river of considerable volume. Rising abruptly out of this plain are isolated blocks of hills, of which the chief are Jebel Hellal, Jebel Yellag, and the Moghrarah hills, all rising to a height of some 3000 feet above the sea.

Following the dry bed of the wady for about 10 miles, the track reaches Bir Lefun, an ancient stone-built well, recently cleaned out, 50 feet deep and with some 6 feet of fresh water. It thence strikes south-west for 25 miles to the Wady Surr, which here emerges from a narrow gorge in the Moghrarah hills, and joins the Wady Arish a few miles north of Jebel Hellal. The Moghrarah hills are much intersected with steep-sided ravines, which all drain into the Wady Surr. They are permanently inhabited by the Minsofia Arabs, a small and somewhat lawless tribe, while in the spring Arabs of the Terebin tribe, as also the Aardi and Tayhah, drive flocks to graze on the pasturage, which is then good. There are several old wells and cisterns, the chief of which is Bir Moghragah, situated some 15 miles within the hills. To reach it one has to follow the main bed of the wady up a winding ravine; near the head is a solidly built but now ruined stone fort. The cistern is hollowed out of the solid rock, and so placed that after rain it is filled by the stream that then flows down from the surrounding hills. When visited by me in December, 1901, the tank was quite full, but as it is tunnelled into the rock it was impossible to ascertain its size. From descriptions given by natives, it must, however, be very large, holding at least 40,000 gallons. The age of the fort and cistern is hard to fix, but from their style they probably date back to Ptolemaic times, viz. about 300 B.C. Some 4 miles beyond the cistern the watershed is reached, and the track, impassable for loaded camels owing to its steepness, leads down through a narrow valley into an open plain. Here, after the winter rain, a little barley is grown, while, as good grazing is obtainable, considerable flocks of sheep and goats are nearly always to be found in the neighbourhood. After crossing the edge of

the shifting dunes, here some 50 feet high, Jebel Gederah is reached. This is an isolated hill rising to 1500 feet, and as water, though somewhat brackish, can in the winter be got by digging in the wadys, it is a favourite grazing-ground for the Aardi Arabs, whose headquarters are near Ismailia. To strike hence direct to Ismailia would entail a very difficult march of 45 miles right across the shifting sand-dunes. These can, however, be almost entirely avoided by making a *détour* somewhat to the south, the left shoulder being brought up when the shore of the Great Bitter lake is reached; thence to where the Suez canal is struck north of Lake Timsah the going is good.

With the exception of the five thousand inhabitants of El Arish, of whom only one thousand are Bedawin, the country from the line Port Said—Ismailia to the frontier of Palestine is very thinly populated, the chief tribes being:—(1) The Terebin Arabs, who inhabit the lower part of Palestine. They are a powerful tribe, owning large herds of camels, many sheep and goats, and a certain number of horses. (2) The Sowarki Arabs, who reside in the low country along the coast from Gatya to Raffa; of these there may be some five thousand (men, women, and children), of whom the majority live near and to the east of El Arish, cultivating barley and breeding camels, sheep, and goats, also a few horses. (3) The Aardi Arabs live around and to the east of Ismailia, and have grazing rights as far as the northern slopes of Jebel Mogharah. They possess a considerable number of camels, also sheep and goats. (4) The Minsofia Arabs live in and around Jebel Moerib, but are few in number. (5) Near Bir Hassanah, and thence to the south-east, are the Tayhah Arabs, whose headquarters are at Nackl. It is difficult to ascertain the number of Bedawin who permanently reside in the desert, but it is very small, as there is an increasing tendency to move to the edge of the cultivation in Lower Egypt, leaving their breeding flocks and camels in charge of dependents. There is but little game in this desert, though near to the Suez canal, particularly between Kantara and the Bitter lakes, there are numbers of gazelle, while in Jebel Hellal, Jebel Jellag, and occasionally in Jebel Moghrarah, the small ibex of the Sinai peninsula is met with. In all the above-mentioned hills a certain number of partridges are found, while in addition sand-grouse and small desert hares are pretty common.

Should it ever be necessary to carry a railway across this desert, I am confident that the best route would be along and close to the sea, as, owing to the ever-shifting dunes, the task of building and maintaining a line crossing the sand-belt would be well-nigh impossible.

A VISIT TO THE HOGGAR TWAREGS.

By W. J. HARDING KING.

With the object of seeing something of the Sahara, and of visiting, if possible, a camp of Hoggar Twaregs which I heard had been seen in the desert south of Tugurt, I set out from Biskra with a small caravan on March 19, 1900, along the great trade-route stretching southwards into the desert.

STREET IN TUGURT.

At a distance of some 17 miles from our starting-point we crossed a small brook, which in dry weather represents the Wad Jedi. This little stream, however, when rain has fallen heavily in the mountains to the west of Biskra, where it takes its rise, becomes a huge and impassable morass, several miles in width, which, since it runs almost due east and west, completely cuts off all communication with Biskra from the desert lying to its south, and, as it sometimes remains in this swollen condition for over a week, causes the greatest inconvenience to travellers.

The desert lying to the north of this stream is called by the Arabs the "Little Sahara," to distinguish it from the "Great Sahara" lying to its south, and from those vast and little-known tracts lying still further south beyond Wargla, which are somewhat vaguely alluded to by them as the "Great South."

Beyond the Wad Jedi the country changed, and the track emerged on to a slightly rolling plain, covered with small scattered bushes and clumps of coarse yellow grass, which stretched away into the far distance to a horizon literally as straight as at sea.

The road, at the season of the year at which our journey took place, carried a considerable traffic, consisting chiefly of caravans coming north from Tugurt and the Wad Rir oases with loads of dates, or proceeding south from Biskra laden with grain. Occasionally a Jew with a few mules laden with barrels of oil was met, or the members of an Arab camp migrating northward towards their summer quarters in the Tell, or fertile district near the coast. The particular tribe to which these caravans belonged could easily be identified by the pattern of the *kerratas*, or camel-bags, with which their beasts were laden, which were striped in red, black, brown, or grey, in streaks of varying widths.

During the course of our second day's journey we passed, at 32 miles from Biskra, the oasis of Shegga, the first we had seen since our starting-place. It is here that the little-used track from El Wad, by which we subsequently returned, joins the Biskra-Tugurt road. We spent the second night in the caravanserai of Setil, 45 miles from Biskra, within sight of which stood a group of some twenty mud pillars erected over the graves of the members of an Arab camp who had been murdered some years before by a party of raiding Twaregs.

For 3 or 4 miles beyond Setil the road, which had hitherto taken us over an almost perfectly level plain, rose very gradually until we reached Kef-el-Dohor, a slight hill overhanging the Shott Melrir, or Shott Merwan, as the western part of it is sometimes called. This hill was the only one we encountered during the whole distance from Biskra to Tugurt. The road descended from its summit by a steep gradient to the bed of the lake, lying below the sea-level, across the dry surface of which it led us almost to Urir, the first of the Wad Rir group of oases. From this point on as far as Tugurt we had always one, and sometimes three or four oases in sight, situated over the bed of the great underground stream, lying from 150 to 600 feet below ground, from which the group takes its name. Some of these oases are of considerable size—Mraier, for instance, contained in 1893 five artesian wells and 80,000 palms, and Urlana and Ghamra had each 30,000 palms. Nearly all of them are increasing rapidly in size under the auspices of the two French companies, the "Société agricole de Batna" and the "Compagnie de l'Oued R'ir," which are both doing excellent work and fast developing the resources of the country. Nearly all the water to be obtained in

this district is brackish, and most of it, of course, comes from a considerable distance below ground. It is an interesting fact that primitive wells on the artesian principle have for centuries been in use in the Wad Rir oases.

The inhabitants of this district, who are known as the Ruara, present quite a different type from any to be seen in Algeria. They spoke a dialect of bastard Arabic, which my guide, who was an inhabitant of Biskra, had the geatest difficulty in understanding. They were nearly

WARGLA, FROM A MINARET OF A MOSQUE.

all black in colour, and many of them showed the frizzy hair, thick lips, and flat nose of the Sudanese negro; but there were others who were of quite a different type. They had the same dark-coloured skin and close-curling hair, but their high, narrow foreheads, thin lips, and clean-cut aquiline noses afforded a striking contrast to the negro type. It would be interesting to compare their faces with those of the Harratin and Zenata of the Twat district.

On the 24th we reached Tugurt, the capital of the Wad Rir district. The oasis, besides the principal town from which it takes its

name, contains several villages, and has a total population of some 6000 inhabitants. Its palm plantations form a perfect forest, containing in all over 170,000 trees. It is the headquarters of a military district, and is the scene of one of the most important markets in the Northern Sahara.

We stayed in the town a few days so as to be present on the market day. Besides carpets, hides, fleeces, dates, scents, spices, and the usual native products to be found in the Algerian markets, there was a considerable quantity of European goods displayed for sale. Among these cottons, cutlery, tinware, and small mirrors in metal frames seemed the principal items. The cutlery and calicoes of French origin were of very inferior quality, but there were a few rolls of English cottons, which showed a marked superiority to those bearing the names of French firms.

In the market were a large number of goats of the black hornless breed, for which Tugurt is famous. Nearly all these goats were disfigured by the abnormal growth of their hoofs, which in one or two cases had become so prolonged that they curled up in front of the legs until they almost touched the shin. Tugurt is built upon very sandy soil, and it is probably owing to the fact that this soft material has little effect in wearing down the hoofs that they have grown to such unusual lengths.

We left Tugurt on April 1, and continued our journey almost due south to Wargla. At 8 miles from Tugurt we passed Temasin, a *ksar* or fortified village similar to those in the Twat district and other parts of the Sahara. The houses on the outskirts of the place all joined up to each other so as to form a continuous wall, from which a small tower projected at intervals. This wall was surrounded by a moat, crossed in two places by a causeway leading to a fortified gate.

Six miles further on we passed Bled et Ahma. Beyond this oasis our road lay over the open desert for 90 miles until Ngussa was reached.

A march from Ngussa of 10 miles through a blinding sandstorm brought us to Wargla, 230 miles from Biskra. The uncovered streets and neatly plastered houses of the town offered a great contrast to the covered tortuous ways and rough mud-built walls characteristic of the old town of Tugurt.

Wargla has lost much in importance since the French occupation of Algeria. In the days of the Turkish rule in Barbary the town was one of the great centres of the trans-Saharan trade, and several times a year huge caravans coming from Timbuktu and the western Sudan poured some of the wealth of those fertile regions into the markets of Wargla and El Golea, whence it was distributed to all parts of the Barbary States. The slave trade was an essential feature of this commerce, and the suppression of this traffic in Algeria by the French

rendered the trade less profitable, and caused it to divert east and west into Tripoli and Marocco respectively. The French operations conducted during the past few years in Twat and other parts of the Sahara and the Sudan have had the effect of suppressing the trans-Saharan slave traffic, and will perhaps for a time restore to some extent the trade to its former channels; but when the proposed routes from the western Sudan to the coast have been opened, an entire revolution in the commerce of this region is almost certain to follow, for transport by steamer and railway cannot fail to be cheaper, safer, and better in every way than the precarious method of camel porterage across the Sahara. The French, there is little doubt, will ultimately extend

STREET IN WARGLA.

their railway along the Marocco border into Twat, and thus bring a European market into the heart of the Sahara. Probably gold-dust, ivory, and ostrich feathers and other articles of the Sudanese trade of high value in proportion to their weight and bulk will continue in small quantities to find their way from the middle Niger district into Twat, and so on into Algeria; but the trans-Saharan trade as it formerly existed is practically at an end.

As we could hear no news of the Twaregs at Wargla after a stay of two days in the town, we retraced our steps by practically the same road as we had come to Tugurt.

The heavy dust-storm which had occurred during our stay at Wargla had completely choked several of the wells with sand. Owing to an

EL WAD, FROM MINARET OF MOSQUE.

PALM GROVES NEAR EL WAD, FROM MINARET OF MOSQUE.

A TWAREG TENT.

A TWAREG SHOWING THE "LITHAM," OR MASK OF BLACK COTTON.

accident, our only water-skin had been allowed to overflow, and, as we had no appliances for cleaning out the wells, for two days we were practically without water at all. We accordingly were compelled to make a slight *détour* off the road to ask for hospitality at the *zawia* (monastery) of Temelath.

This is one of the principal monasteries belonging to the Tijani order, whose adherents are widely spread over the north of Africa and the Sahara. In size it resembles a small desert town. Considering its

HOGGAR TWAREG (A NOBLE).

situation in the heart of the Sahara, it is a wonderfully well built and highly decorated place. Not only the great mosque and all the principal buildings which it contains are decorated with coloured arabesques in raised stucco, but even the arcades spanning its streets are ornamented in the same way. The reigning marabout was a pleasant old gentleman of some sixty years of age, who had evidently a considerable quantity of negro blood in his veins. He entertained us royally, put us up for the night in a new *dar-dief* (house for

strangers) which had just been finished, and which was, if anything, a shade more gorgeously decorated than the mosque itself, and finally dismissed us on the following morning with a day's provisions and a blessing upon my Moslem followers.

On our return to Tugurt, we found that the Tarawek camp, of which we had been in search, was pitched in the neighbourhood of El Wad, and we accordingly set out in search of it.

Our road from Tugurt lay nearly due east. Almost as soon as we

HOGGAR TWAREG (PROFILE).

had left the oases we got among the sand-dunes, across which our road lay all the way to El Wad. These, though low at first, gradually increased in height as we neared our destination. The soft cream-coloured sand, which was almost as fine as the dust on an English highway, was extremely trying to both men and beasts to walk over. In ascending or descending the slopes, even the camels' legs sank in almost to the hocks. The glare, too, was very trying. Huge stone pyramids (*guemeerahs*) had been erected at intervals of about 10 miles

all along the road to act as landmarks. In all directions could be seen raised lines marking the mole-like course of a little burrowing lizard known to the Arabs as the *hout-el-erdth*, or "earth-fish." The sand at midday was so hot as to be almost unbearable to the naked hand. The nomadic Arabs, when suffering from an attack of fever, or when wishing for some reason to throw themselves into a perspiration, cover their heads in their clothing and burrow into the side of a dune, where they remain until the desired effect has been produced.

Three days' journey, at the end of each of which we found a caravanserai, brought us to El Wad.

El Wad is built over the bed of a subterranean river—the Wad Souf—on the northern edge of that great belt of sand-dunes which runs, with an occasional break, all along the southern boundaries of Tunisia and Algeria. In forming a palm grove in this district, the natives choose one of the deepest hollows between the dunes, and excavate it still deeper until the water-level is nearly reached before planting the palms. The labour entailed in the construction and maintenance of these oases is enormous, for, in addition to the usual work required in a palm grove, the proprietors are compelled to wage perpetual war against the ever-encroaching sand, which with every breeze drifts in over the edge of the hollow, and, unless collected periodically, brought to the surface, and thrown out again, would soon smother and kill the whole plantation. The cultivator gets, however, a good return for his labour, for the crops in this district are far heavier than even in the famed oases of the Wad Rir group.

Half a day's march from El Wad brought us past the oases of Kouinin and Tarzout to Gomar, where there is a *zawia* affiliated to the same order as that at Temelath.

A few miles to the north-east of this oasis we found the Twareg camp of which we had been in search. Its inhabitants described themselves as belonging to the Hoggar tribe, and said that they had come up to buy some things at El Wad after camping for some time among the Askar Twaregs.

They were a tall, lanky lot, varying in colour from almost black to the complexion of a Spaniard or an Italian. The men all wore their characteristic *litham*, or veil, which concealed the whole of their features and in some cases even their eyes, so that, with the exception of their hands, feet, and a few coarse snaky-looking locks of greasy hair which stood up above their head coverings, nothing whatever of their persons was to be seen.

The tents which their camp contained were all constructed of leather, and, with the exception of that which belonged to the chief, were extremely small. The chief's tent was built with a span roof and sides about 4 feet high. Its furniture consisted of leather sacks containing clothing, eatables, etc., and a few richly coloured rugs made

with a 3-inch pile, and strewn with leather cushions cut and dyed with a decorative pattern. Two projecting wings which overlapped at the ends stood out, one on either side, from the open end of the tent, forming a kind of outer court, so as to ensure complete privacy for the inmates. This open space was partly covered during the daytime by an awning, which at night was let down to close the end of the tent.

The dwelling was used as a kind of school for the junior members of the camp. The women, being the more highly educated sex, were the teachers. In one corner of the tent lay a small board covered with Arabic lettering, with which some of the children were being taught to read in that language, after having presumably mastered their own. The Twareg alphabet is, of course, entirely different from the Arab.

Our return journey from Gomar lay, until Shegga was reached again, all across the open desert, and presented few points of interest. There was a caravanserai at the end of each day's journey. At Sif el Menadhi we found one of the so-called "desert mosques," a small enclosure built of stones, measuring about 5 feet square, with a niche at one end to indicate the direction of Mecca. This was used as a place for prayer by the Arabs of the surrounding desert. A journey of four days from Gomar, during the course of which we twice crossed a branch of the Shott Melrir, brought us again to Shegga, from which point our road to Biskra was identical with that of our outward journey.

HOT SPRINGS AND VOLCANIC PHENOMENA.*

By Prof. EDUARD SUESS.

In immediate proximity to the most remarkable hot spring of the European continent, it seems appropriate to direct your attention to the question of the causes to which such springs are due. The older views set forth in the text-books tell us that hot springs are fed by water percolating down from the surface of the ground, which at a certain depth attains a high temperature, and ascending again at that temperature, brings with it in solution solid substances from the rock. From these conditions it might be possible, knowing the mean gradient of temperature from the surface downwards, to assign approximately a minimum depth reached by the percolating water, and by analysis of the water to learn something of the composition of the rocks through which it has passed.

But in 1880 Franz von Hauer, F. von Hochstetter, and Heinrich Wolf, when consulted with reference to the preservation of the Karlsbad springs, expressed considerable doubts as to the water of the springs coming from the extensive infiltration area, chiefly composed of granite, in the neighbourhood. G. Laube found it impossible to account for either the quantity of water itself or of the carbonate of lime in the deposits, on the hypothesis that they were derived from granite. Ludwig and Mautner had similar difficulty in accounting for the sodium

* Abstract of lecture at the meeting of the Congress of German *Naturforscher und Aerzte*, held this year in Karlsbad. By Prof. Eduard Suess.

present, and suggested that the bulk of the matter in solution must be derived, not from the granite, but from the unknown under-strata of the Earth's crust. Rosiwal was unable to find any correspondence between the yield of the hot springs of Karlsbad and the distribution of rainfall in the region, and concluded further that the carbonic acid must be derived from a heated magma.

It is likely that similar difficulties have been experienced in many regions where hot springs occur. My intention is not to present to you a new theory, but rather to redirect attention to an old one, which, undeservedly as I think, has lately fallen somewhat into the background. But before doing so, I must, for the sake of brevity in what follows, explain the meaning of two expressions. In a well-known paper on metallic veins, published in 1893, Posepny has used the term "vadous" to distinguish infiltrating waters, *i.e.* those of superficial origin, in contradistinction to waters rising up out of the depth. We shall retain this expression, extending it so as to include not merely percolating waters, but all the waters of the hydrosphere—oceans and rivers, clouds and rain. Vadous waters, often impregnated with carbonic acid, penetrate from the surface into the upper strata, where by solution and deposition they form deposits of mineral substances. The waters which, having been warmed, come to the surface in artesian borings are vadous. Thus we may also have vadous carbonic acid, which appears with marsh-gas in coal-beds, and vadous compounds of chlorine, bromine, iodine, and sulphur in the oceans and in salt deposits. The sulphuretted hydrogen separated by the action of bacteria in the depths of the Black sea is also vadous.

The second expression to which I would refer is "pulsation" as applied to springs. There are two kinds of pulsating springs. First, the type of pulsation familiar in the geysers of Iceland. The geyser has a cylindrical tube formed of sinter. Blasts of superheated steam, entering the tube laterally at great depths, are subjected to the pressure due to the column of water in the tube, which raises the boiling-point, let us say, from 100° to 124° C. Successive hot blasts eventually raise the temperature to 124°, and the explosion follows: the upper column of water is blown into the air, water is suddenly discharged from a lower column below the point where the steam entered, the cylindrical tube is emptied, and then slowly refilled from below. We observe that the blasts of steam are hotter than the column of water, the temperature of which rises till the explosion occurs, and then sinks. Pulsating springs of this kind may be specifically termed geysers, or boiling springs.

The Karlsbad springs are also pulsating, but the pulsations are less regular; they occur at short intervals, and are due to a different cause. Over the system of springs lies a mass of deposit, pierced by numerous holes. In this mass carbonic acid gas collects until its pressure is sufficient to force the water out, and since the cavities are irregular, so also is the rhythm of the springs. Springs of this type may be called "bubbling springs" (*Sprudel quellen*). Here we have an important distinction. Boiling springs are not subject to hydrostatic pressure like the waters in artesian wells. The characteristic of hydrostatic pressure is its uniformity; intermissions of long period would be impossible. In the case of the bubbling springs it is difficult to judge from the nature of the movements, but in Karlsbad at least a continuous hydrostatic pressure up to the surface cannot be admitted.

The occurrence of periodic variations in the action of certain volcanoes has long been recognized; these are commonly known as "strombolic" phases of eruptive action, and the quiescent pauses may be anything from a few seconds to several hours. In this connection I may be allowed to describe an experience which made a great impression on me at the time. In January, 1871, Vesuvius

formed a "parasitic" crater at one side of the main crater, and 60 or 70 metres below it. Looked at from a distance, this crater presented the appearance of a jagged protuberance on the side of the main cone of the volcano. On the night of March 31, the weather being clear, as we were standing on the St. Lucia quay in Naples, we distinctly saw rhythmical flashes issuing from the small crater at intervals of six to eight seconds, while similar flashes came from the main crater once in two minutes. The two centres of activity were thus to a certain extent independent of one another, but since they must certainly have been fed from a common deep-seated vent, the separation must have taken place comparatively near the surface, and only the upper part of the vent can have been concerned in the rhythmic movements. The analogy with the geyser was so close that one was forced to the conclusion that Vesuvius is merely a form of boiling spring. On the following day we were able to enter the parasitic crater, and saw the flame bursting out of the vent to the height of about a métre every six or eight seconds; bubbles the size of one's head were blown out of the glowing mass, and blazing pieces of slag hurled into the air; then the flame sank, and a new skin of slag formed over the mouth of the vent, to be blown off in turn by the next explosion. Clouds of steam hovered over the outlet, and hydrochloric acid and acids containing sulphur were present. The general appearance was simply that of a geyser, which ejected melted stone as well as heated gases. Stones were also thrown out by the main crater of Vesuvius. Each of these seemed to draw a tail of steam behind it, and as they fell on the ashes in front of us they were covered with a white crust of sodium chloride. We were confronted again with the old puzzle: the eruptions themselves seemed to be caused by steam, as in the geysers, and the chloride of sodium pointed to the sea beneath us, but how could sea-water percolate into regions of such extraordinarily high temperature? Thirty years separate us from the experience of that day; the same puzzle has presented itself to many investigators in that time, and with a multitude of new observations to help us, we may turn again to seek a solution of the problem.

Silvestri observed the rhythmical action of Etna before the eruption of 1879; Mercalli studied Vesuvius in different years; and Bergeat has made observations on Stromboli. It is obvious that in a natural phenomenon like this one cannot expect the precise regularity of the pulse of a living creature—small lateral passages in the depth, and similar fortuitous circumstances, often cause the periodic outbursts in boiling springs to be preceded by a series of smaller disturbances, which follow no regular period, and the true rhythm of the main explosions is only recognized when the smaller ones are neglected. The great feature of the boiling springs is the irregular entrance of the gases, the explosive power of which increases towards the mouth of the vent.

I believe that the blasts of hot gas in the parasitic crater of the volcano are the source of heat, in precisely the same way as the blasts in the sinter tube of the geyser, and that they are the primary cause of the melting of the lava and of its intermittent outpouring. One is strengthened in this view by the circumstance that sounds like reports of subterranean cannon usually precede great eruptions, the result of the access of superheated vapour to cooler surroundings. These dull reports become gradually more frequent, until at last the first white ball of steam is shot out of the crater; the boiling lava follows later, itself saturated with steam. Be this as it may, it is at least certain that the quantities of steam issuing from the parasitic crater must come from a zone in which the temperature equals or exceeds the melting-point of most rocks, and in which there can be no question of porous or fragmental rocks, and therefore no question of infiltration of vadous water.

Turning now to the gases accompanying the eruptions. After steam, chlorine and gases containing sulphur, are the most important, and carbonic acid gas comes next. Their occurrence follows a definite law. So far as it has been possible to approach them, all fumaroles actually within vents contain steam; but the hottest fumaroles (over 500° C.) on the surface of cooling lava-streams, where approach is easier, are dry. In the emanations from these high-temperature fumaroles are found chlorine compounds, and along with them fluorine, boron, and phosphorus, substances which are the first to disappear as the temperature of the fumarole sinks. Sulphur persists longer, often combined with arsenic. Carbonic acid is given off freely till a much later stage, sometimes till the fumarole is comparatively cool, notwithstanding that it is observed in the hottest dry fumaroles. Fumaroles in different "phases of emanation" may occur quite near one another. The steam of the volcano cannot be derived from vadous infiltration, for if it is, whence the carbonic acid? Both must come from the deeper regions of the Earth; they are the outward sign of the process of giving off gases which began when the Earth first solidified, and which to-day, although restricted to certain points and lines, has not yet come to a final end. It is in this manner that the oceans and the whole vadous hydrosphere have been separated from the solid crust. Volcanoes are not fed by infiltration of the sea, but the waters of the sea are increased by every eruption.

From volcanoes, we come naturally to the question whether the water of boiling springs is vadous or hypogene. The Erzgebirge, which structurally belong to the Karlsbad granite, are traversed by numerous veins, *i.e.* by cracks or fissures, filled up sometimes with quartz or hornstone, sometimes with the ores of different sorts from which the mountains derived their former value and the name they still retain. The mining industry, and the studies of the famous Freiberg school, have made us acquainted with the formation of the Erzgebirge; and one of the most distinguished representatives of the school, whose name cannot be mentioned in an assembly of German naturalists without evoking expressions of enthusiastic admiration, Hermann Müller, recognized more than forty years ago the bearing of these mineral veins on the question we are now discussing. Since the hottest fumaroles of a volcano are dry, the deposits found in them must be the products of sublimation: all later, or *sulphide*, fumaroles contain water, their deposits will be stratified or banded, and in the succession of deposits the greater solubility of the compounds comes into prominence. With reference to this we may quote the following experiments on the nature of mineral veins. Deposits of tin belong to the hottest type, in which the temperature is higher than occurs in thermal springs, and for the most part higher than that of the "sulphide" phase of vein-formation. In contrast to this, the hot springs may be taken as the latest phase of a whole series which led up to the present deposits of ore: such springs occur here and there throughout these deposits. They are for the most part alkaline, and sometimes extraordinarily rich in sodium chloride; the amount of salt in the Karlsbad springs is remarkable, issuing as they do from granite. But the alkalies are not found in the ore deposits, not because they were absent at their formation, but because of their greater solubility. Thus we have at the one extreme the tin layer, at the other the alkaline hot spring with free carbonic acid. In the mine we can recognize the traces of the fumarole above 500° C., as well as of the tepid salt ascending water. Vadous influences are not wanting in the upper levels, but they are adventitious, and the alkaline hot springs in the fissures are only the last of a series of events which have their origin deep in the Earth's crust; in spite of their low temperature, and their carbonic acid, they are to be regarded as hypogene waters. Karlsbad is situated on the outcrop of a vein. It now becomes possible

to interpret the observations of the miners. If we could clear away all disguises, and clearly see the system of springs as a whole, we should see that it pierces the granite in two distinct ways: in one part it is covered by its own deposits of lime, but in the depth are deposits of hornstone, binding fragments of the granite into a breccia exactly as the springs of Plombières do in the Vosges, notwithstanding their lack of soluble matter. Veins of hornstone and also of arragonite extend through the surrounding granite, and the observations of Knett leave it an open question whether the deposits of Karlsbad are not intermediate between hornstone and limestone.

The relations of hot springs to mineral veins are further of value in the interpretation of their chemical composition. The efforts of experts have recently been directed afresh to finding an explanation of the filling up of veins by lixiviation from the surrounding rocks, but exact experiments have proved that filling up in this manner, without addition of material from the depth, is inexplicable. The case is similar to that of the Karlsbad springs. At Vesuvius the nearness of the sea made it doubtful at first if the salt were not of marine origin; but here, in the middle of a continent, the salt appears again, both in springs tapped by mining and in the Karlsbad springs. The substances coming from the depth consist of readily soluble compounds, while other more easily separated substances—the metallic compounds—remain behind. To this we must ascribe the quantities of Glauber's salts, soda, and sodium chloride, to which the waters of the Karlsbad springs owe their curative properties. The great quantities of free and loosely combined carbonic acid are undoubtedly of hypogene origin; we know that they correspond to a late phase of volcanic activity, following the basalts. If we look at the elements rather than the compounds which occur in the Karlsbad springs, we find traces of older phases. From the hottest stage we have chlorine, fluorine, boron, and phosphorus, while the metals of this stage—tin, bismuth, molybdenum, etc.—are wanting. Sulphur is present, and with it selenium and thallium, rubidium and cæsium, the accompaniments of the sulphide phenomena in many volcanoes; also arsenic and antimony, the ordinary representatives of the sulphide ores, and zinc as a relic of the ores themselves. There remain sodium, potassium, and lithium; calcium, magnesium, and strontium; iron and manganese; aluminium and silicon. Every one of these is met with in mineral veins, and nearly all occur as volcanic products.

To sum up. The temperature of the gases ascending in volcanoes equals or exceeds that of the melting-point of most terrestrial rocks, and these gases cannot be derived from vadous infiltration. The hottest fumaroles are dry; steam and the substances dissolved in hot springs belong to later phases. The covering of tin on the sulphide veins of the Erzgebirge corresponds to the hottest subliming phase of this stage of activity; the other veins—the real sulphide ores—belong to a later stage. The hot springs which burst from the surface at the present day are but a relic of this stage. Along with them we may place the issuing streams of free carbonic acid, noting their close connection with the great basalt zone of northern Bohemia, extending into Silesia.

We may therefore conclude that there are vadous springs and hypogene springs. The term "hypogene" may be applied to springs which are the survivors of volcanic activity, originating in the depths of the Earth's crust, and bringing water to the surface for the first time. As the use of this term, here applied to curative springs, is based on geological considerations, I need hardly guard myself against erroneous therapeutic applications of it. The water of the Karlsbad springs is hypogene water.

All attempts to delimit an infiltration area at the surface for these springs, or to ascertain the depth from which the water rises out of a so-called thermal layer,

are vain. Any attempt to determine the general structure and composition of the granite is equally hopeless; the cavities from which, according to an old estimate, 5,880,000 kilograms of solid material are removed every year, do not exist. Karlsbad stands on a drift of hornstone. If its warm waters still separate the heavy metals in the depths, a mineral vein is in course of formation, and the waters reach the surface impoverished; but it is hardly possible to ascertain whether such action is going on, although it is suggested by the arsenic, antimony, and zinc.

Springs may be easily classified into five groups. First, the ordinary fresh-water spring. Second, springs of vadous water, having the mean temperature of the soil, but characterized by special mineralization, like the iodine waters of Hall and Darkau, and the bitter waters of Saidschütz and Püllna. Third, mineral baths (Wildbäder). Fourth, hypogene springs, not varying in temperature or quantity with the seasons of the year, and having any degree of warmth from the mean temperature of the soil up to over 70° C., sometimes neutral, sometimes weakly mineralized with small quantities of Glauber's salt, common salt, or soda, and sometimes strongly mineralized with the same substances; for example, Marienbad temperature (11°·2 C., from granite) and Karlsbad (73°·8 C., from granite). The fifth group includes the boiling springs, of which no example occurs on the continent of Europe. The free carbonic acid stands, to a certain extent, in an independent position, as is shown by the quantity of it in Karlsbad, and the number of cold acid wells and dry exhalations of carbonic acid gas.

The five groups of springs named do not include every species of spring, and they are not equivalent. Groups one, two, and three are vadous, groups four and five hypogene. As the water flows away from the well, it cools, deposits some of its mineral contents, and mixes with the vadous surface water. Other substances in solution, notably the alkalies, are added to the world's stock of material. The Karlsbad springs bring up more than a million kilogrammes of new salt every year; the sea is not the provider but the consumer of salt, and the many remarkable similarities of composition in the waters of hot springs and of the sea become intelligible; the salts of the sea are now vadous, but they were once hypogene. But the atmosphere as well as the sea is enriched from hypogene sources. All the vast quantities of carbonic acid which issue from the soil at a hundred places, from here along the southern border of the Erzgebirge, and even farther to the east, are hypogene, and they are added to the contents of the atmosphere, except in so far as they are absorbed by vegetation.

We have been brought to the discussion of questions remote from the subject of my lecture. The hottest dry fumaroles, forming deposits of the ore by sublimation, the rain of hydrochloric acid from Vesuvius, and the salt of the Altensalza mines, the hot vapours which recently burned the bodies of the unfortunate victims at Martinique without setting fire to their clothes, and the warm healing waters which rise up here before our eyes, are members of one indivisible series of phenomena. The Earth is still giving off gases in a manner which may be compared to what we observe in the spots on the sun, or on every large mass of cooling steel.

GEOGRAPHY AT THE BRITISH ASSOCIATION, BELFAST, 1902.

THE meetings of Section E of the British Association, under the presidency of Colonel Sir Thomas H. Holdich, R.E., C.B., K.C.I.E., were very successful, although the number of papers and reports, eighteen in all, was smaller than usual. In

the importance and interest of the subjects there was no falling off, and the attendance was good, although the Geography Section was not accommodated in the main buildings of Queen's College along with the majority of the other sections, but in a large and convenient lecture-room connected with the Methodist Church.

The office-bearers of the section were the following :—

President: Sir Thomas H. Holdich, K.C.B., K.C.I.E., F.R.G.S. *Vice-Presidents:* Dr. H. O. Forbes; Dr. J. Scott Keltie; Dr. H. R. Mill, F.R.S.E.; Prof. J. Milne, F.R.S. *Secretaries:* G. G. Chisholm, M.A., B.SC. (*Recorder*); Edward Heawood, M.A.; Dr. A. J. Herbertson; Dr. J. A. Lindsay. *Committee:* Colonel E. Bailey, late R.E.; Mrs. Bent; John Bolton; W. S. Bruce; Colonel D. A. Johnston, R.E.; Prof. W. Libbey; Dr. F. Moreno; Miss Marion Newbigin, D.SC.; James Robinson, M.A.; Miss Ella Sykes; Major P. Molesworth Sykes.

The President's address, which was printed in the October number of the *Journal*, was a most valuable survey of geographical problems of moment from the point of view of the practical geographer. The papers were almost equally divided between accounts of little-known regions and discussions of special problems of distribution in selected areas, and it is most encouraging to find that in six cases the area chosen was within the British Isles. The proceedings at the Belfast Meeting bore witness to the welcome change which is taking place, in the interests of our geographers, from descriptive topography to scientific geography.

In a geographical journal it is more natural to group the papers according to their relations to space, and not in that of their sequence at the meeting. We shall follow the advice of most educational experts and begin with Ireland, the home of the Association this year, pass over the continents to the polar regions, and finally consider the great globe itself.

Meeting in Ireland, it was natural that several Irish papers should be read during the meeting. Some of these were not read in the Geographical Section. The general description of the geography of Ireland was combined with an account of its geology, and was given in the Geological, and not in the Geographical, Section by Prof. Grenville A. J. Cole. This was illustrated by magnificent lantern slides, many of them the work of Mr. Welch, that rare man the professional photography who has scientific interests. Mr. Welch's slides are, or ought to be, well known to all who have to teach geography. A similar description of the Belfast district was also given by Prof. Cole in the Geological Section.

Dr. Mill read a paper to the Engineering Section on "the Rainfall of Ireland," which he illustrated by maps showing the rainfall distribution for ten and for thirty years.

The botanical geography of Ireland was discussed by Mr. Lloyd Praeger, who dealt with it from the morphological rather than from the physical point of view, from statistics of species rather than from associations of plants. This is, of course, the most valuable method of going to work for the investigation of historical problems; the other is the more useful for the economic geographer. A full abstract of Mr. Praeger's paper will appear in the *Journal*.

Prof. Johnston, of Dublin, dealt with the peat question, which he has made his own. He showed a beautiful map of the distribution of peat-bogs in Ireland, which we should like to see reproduced on a smaller scale. He discussed the economic uses to which peat has been put, and illustrated his remarks with specimens. He pointed out that the bad name which peat-litter possesses in many quarters is due to its not being peat-litter. True peat-litter is composed of sphagnum, whereas the litter usually so called in commerce is largely composed of cotton grass, which does not possess the marvellous absorptive powers of the dried peat-moss. One of his statements must appeal to all students of economic

geography. A company determined to utilize a peat-bog in the west of Ireland, and erected plant for making briquettes from peat. The briquettes were excellent, but, owing to the cost of freight, they could not be put upon the Dublin market at as low a price as coal from across the sea. From lack of consideration of the geographical-economical factors the company failed.

Another Irish official, the Rev. W. Spotswood Green, Chief Inspector of Fisheries, described the attempt made in 1896 to visit Rockall, an account of which will be found in the *Geographical Journal*, vol. ix. (1898), pp. 48–50. He showed a number of fine views of this sharks's tooth-shaped islet, on which birds alone seem to be able to alight, and pointed out its possible connection with islands marked on old charts. The nesting-place of the great spearwater was not seen, although the bird itself was.

The valleys of Southern Ireland have long been a puzzle. Jukes's classic memoir called attention to them, and his ingenious explanations of the consequent streams being beheaded have led, not merely to similar explanations of the drainage systems of other regions, but to vaster generalizations, which have had a most stimulating effect on both physical geographers and geologists, even on those who have assailed them most vigorously. Jukes's interpretation of the southern rivers of Ireland do not quite satisfy a student of the large-scale map, any more than Hull's hypothesis of conveniently situated fractures. Mr. Porter gave a vigorous account of these valleys, and showed a contour-map of County Cork made by him, a very necessary instrument in their study. He interpreted the transverse gorges across the west-east ridges of this part of the Armorican Highlands as due to glacial interference. The curiously right-angled courses of the tributaries of the longitudinal valleys he considered were the outcome of faulting and the torrential character of pre-glacial streams. A full abstract of his paper will appear in the *Journal*.

The consideration of the rivers of England from the point of view taken by Jukes in Southern Ireland has led Prof. Davis, and following him Mr. S. S. Buckman, to elaborate theories of a consequent drainage from the Welsh mountains to the south-east of England, which has been modified by the erosion along the softer Lias clays of the Avon-Severn valley. This has raised much controversy, which is by no means ended. Evidence of this diversion of drainage has been sought by Davis in the "misfits" of the present streams for their valleys (see *Geographical Journal*, vol. v., February, 1895, and the *Proceedings of the Geologists' Association*, vol. xvi., May, 1899). Dr. Herbertson, of Oxford, communicated a preliminary note on his studies of the Evenlode valley, one of Davis's consequent streams. He pointed out that, while he had no reason to doubt the reasonableness of Davis's general position, the misfit in the Evenlode windings could hardly be due to the diversion of a Welsh river to the Bristol channel, as the erosion of the Avon-Severn valley below the level of the present divide between it and that of the Evenlode was too great to be the equivalent of a mere shrinkage on the valley flow. Further, the configuration was complicated by a succession of levels, each of which required explanation, and of which all could not be due merely to differences of rock structure. The windings of the Evenlode, incised from 100 to 150 feet below the plateau level, must have been initiated at a greater elevation, when the stream flowed on the Oxford Clay, and not on the limestone. He also drew attention to a wide winding furrow from the Windrush valley, which joined the Evenlode above the most marked of the Evenlode meanders.

Prof. W. W. Watts treated of Charnwood forest as an old mountain region buried beneath Triassic deposits, above which the ancient mountain-crest crops out here and there. The paper, which was admirably illustrated, as befitted one by

the secretary of the Geological Photographs Committee, will appear in full in the *Journal*.

Dr. T. N. Johnston sent an account of the work of the Pullar Memorial Survey of the Scottish lakes, which was read by Mr. Chisholm. Over one hundred lakes have now been surveyed, and a preliminary account of the work appeared in the *Scottish Geographical Magazine* for August, 1902. Curves were shown illustrative of the seiches which have been observed in some of the larger lakes (see Mr. Parsons' note in *Nature*, June 12, 1902).

Prof. Libbey, of Princetown University, New Jersey, greatly added to the interest of the meetings by giving three addresses on his investigations, two on his studies in Syria, and one on his expeditions to the arctic regions. All were illustrated by slides, which were skilfully chosen to exhibit points of scientific interest, and were of exceptionally fine technique and beauty.

In his paper on the Jordan valley, Libbey described a complicated series of transformations before the Syrian rift-furrow took its present shape. He considered that the first stage was the formation of a fault in the Cretaceous period, which marked out the line of the present furrow. A glacier then filled the valley as far south as the Sea of Galilee, and perhaps throughout its length. Depression followed, due to lateral pressure from the west, and 4000 feet of sediment were deposited as far north as the Sea of Galilee. A period of uplifting succeeded, during which 3000 feet of the sedimentary rocks were worn away. Then the glacier vanished, or the water-supply diminished, or the rate of elevation increased, or all three took place, and water ceased to flow over a local rising, which caused a hump at the present divide to the south of the Dead sea. Subsequently elevation through another 1000 feet occurred. The valley, then, is fundamentally due to fracture, but it owes much of its present configuration to erosion of ice, water, and wind.

From the Jordan valley Prof. Libbey showed a series of views which took the audience through narrow gorges, almost meeting overhead like the gorge of the Aar above Meiringen, to the wonderful depression of Petra, the rock city of Moab. He showed the Roman amphitheatre, where "the monarch and his minions and his dames viewed the games," surrounded by tombs and temples hewn out of the solid rock. As Mr. Chisholm pointed out, to hew a temple in the solid rock is really less difficult than first to quarry, then to chisel, and finally to fit together the masonry of a cathedral. Prof. Libbey showed that these rock temples cut in soft rock have resisted the "tooth of time," while the city proper has crumbled into dust, save for a single temple and a triumphal arch. He showed pictures of the "high places" of Moab, and of the panoramas seen from them.

Three other papers on parts of Asia were read by the Englishmen who know most about them. Major Sykes described Southern Persia, traversing practically the same ground as he did in his paper to the Royal Geographical Society (see *Journal*, vol. xix. p. 121).

Captain Ryder has spent two seasons surveying in Yünnan, being attached by the Government of India to a survey carried out by Major Davies for the Yünnan Company, with a view to definitely settling the Burma-China railway question. Captain Ryder will describe the results of his exploration at an early meeting of the Society.

Exploration seems to attract Cambridge men at present, and the latest to venture far afield is Mr. C. H. Hawes, who has recently visited Sakhalin and seen something of the interior of that little-known island and of its inhabitants. The Russians far outnumber the natives, and for most Englishmen Sakhalin, if known at all, is associated with the worst prisons in the Russian Empire. The island, however, is of intrinsic interest. It lies north of the volcanic zone,

and is composed of Tertiary rocks, argillaceous sandstones, calcareous schists, and even coal, which is abundant in the west. It is 600 miles long, and may be compared in length and latitude with the distance between the Lake of Geneva and the mouth of the Elbe, although climatically it rather resembles the corresponding latitudes in eastern North America from Prince Edward island to the middle of Labrador.

Two other papers on Asia were read at other sections. Prof. Herdman gave an account to the Zoological Section of his recent expedition to the Indian ocean, and described by word and picture the ways of the pearl divers in the Gulf of Manaar. Dr. Henry presented a most valuable account of the Lolos of southern China to the Anthropological Section.

The only African paper, by Mr. R. B. Buckley, C.S.I., dealt with the economic geography of Uganda and the British East African Protectorate from the point of view of an engineer studying its possibilities, especially through irrigation. The prospects of great irrigation works do not seem to be very hopeful, for much of the region is deficient in rainfall. Mr. Buckley's paper will appear in the *Journal*.

Although polar exploration attracted most attention at the meeting, it may be dismissed very briefly here, as it is so fully dealt with in the *Journal*. Prof. Libbey read Sir Clement Markham's reassuring note about Captain Sverdrup, and for himself expressed every confidence in Peary. A few days later both were justified, for the explorers themselves notified their safety. Libbey's account of an expedition to carry supplies to Peary, and to attempt to relieve two young Norwegian explorers, was listened to by a crowded audience.

Dr. Mill gave an excellent summary of the different stages of antarctic exploration, illustrated by numerous well-selected lantern slides. We felt once more, as we watched how he carried every one with him through this long story, how very deplorable it is that Dr. Mill should have been permitted to give up the cultivation of the pecuniarily unfruitful fields of geography.

Mr. Bruce, leader of the Scottish Antarctic Expedition, showed views of the antarctic taken by him in 1892–93, and others made by him in the arctic, which illustrated the contrasts between the conditions of these opposite areas. As the *Scotia* could not be brought to Belfast in time, owing to the exceptionally heavy repairs constituting her practically a new vessel, he exhibited slides of the vessel and her chief fittings. He gave an outline of the proposed work of the expedition and of the personnel of the staff, upon which the account printed in last month's *Journal* (*q.v.*) was based.

The World-shaking earthquakes, in their relation to volcanic eruptions in the West Indies, were deftly handled by Prof. John Milne, whose account of them will be printed in an early number of the *Journal*.

The report of the Committee on terrestrial surface waves and wave-tide surfaces, prepared by Dr. Vaughan Cornish, was read. The main results have already appeared in different communications by the author to the *Journal*.

A number of excursions were arranged for the Saturday. One party started very early in the morning for the valley of the Boyne, another visited Rostrevor and Carlingford. Those who went to Newcastle and the Mourne mountains had a too full programme for the time. The coast road driving-party were enthusiastic about everything except the weather. The greatest number visited the Giant's Causeway, and found the arrangements made most excellent. A convenient little pamphlet was drawn up for each excursion by Mr. William Gray, the honorary secretary of the excursion committee. A more extended tour round the Antrim coast was carried out by some members after the close of the proceedings in Belfast.

In conclusion, a word of praise must be added for the compact 'Guide to Belfast

and the Counties of Down and Antrim,' prepared by the Belfast Naturalists' Field Club, and edited by Messrs. F. J. Bigger, editor of the *Ulster Journal of Archæology*; R. Lloyd Praeger, editor of the *Irish Naturalist*; and John Vinycomb. It contains the following chapters: "Belfast Historical and Descriptive," by J. Vinycomb and A. Wilson; "Physical Features and Geology," by J. St. J. Phillips; "Botany," by H. Hanna, R. L. Praeger, and the Rev. C. H. Waddell; "Zoology," by G. H. Carpenter, J. N. Halbert, the Rev. W. F. Johnson, A. R. Nicholls, H. L. Orr, R. Patterson, R. L. Praeger, R. F. Scharff, R. Welch, and J. Wright; and "Antiquities," by F. J. Bigger and W. J. Fennell. The handbooks are often of the greatest value to the geographer, and the present one is among the best. It contains cuttings from Bartholomew's new $\frac{1}{4}$-inch contoured map, and of his $\frac{1}{10}$-inch geological map of Ireland, the latter map unfortunately not yet published for the whole island.

REVIEWS.

AFRICA.

Scientific Results of Captain Ch. Lemaire's Expedition in Central Africa.*

Our knowledge of the interior of Africa has made such rapid strides during recent years that it would be difficult to find a region of any extent that is now entirely unexplored, and the time has almost ceased to exist when a mere rough and ready route-sketch, furnished by a traveller who has little or no previous training in surveying, is likely to be of any real value. What is wanted now is something far more reliable than prismatic compass route-maps, and it is to be hoped that before many years lines of connected triangulation will be extended and carried across different parts of the continent, thus forming the basis of subsequent reliable surveys. Until this takes place, and when it is found impossible to carry out any system of triangulation, doubtless the best course to adopt for a journey of considerable length, and the survey work that is likely to give the most satisfactory results, is that of the character conducted recently by Captain Ch. Lemaire for the Congo Free State, from Lake Tanganyika along the Congo-Zambezi watershed, which depends for its accuracy upon positions fixed in latitude and longitude at frequent intervals by a large number of astronomical observations. A brief general account of the most important part of this journey was given in the *Geographical Journal* for February last, but this gave little idea of the amount of valuable observation and survey work performed by the expedition, to obtain which it is necessary to inspect the scientific report which has been prepared by Captain Lemaire, and recently published in sixteen parts, or "memoirs," as they are called. The first of these gives a general table of the results of the observations for latitude, longitude, altitude, magnetic declination, inclination, and horizontal intensity, taken at one hundred and ninety-five different stations along the route, and will be useful to cartographers and others for ordinary purposes of reference, although it should be stated at once that many of the altitudes here given have since been slightly modified, and a corrected table appears in the last part, No. 16, of the report which has lately been published. Preceding the general

* 'Mission Scientifique du Ka-Tanga. Résultats des observations astronomique, magnitiques et altrimétriques.' Par le Capitaine Charles Lemaire, du 2me Régiment d'Artillerie, chief de la Mission. Publications de l'État Indépendent du Congo.

table of results in Part i. is an introductory chapter, setting forth very clearly the necessity for more accurate determinations of positions of places in this part of Central Africa, and giving an account of the method of observation and formulæ for computation employed. This chapter also gives a description, with illustrations, of the instruments used, of which the principal were as follows: (1) A meridian circle, or transit instrument, by Secrétan, Paris, of 56-millimètre (2·2 inches) aperture, 55 centimètres (21·65 inches) focal length, with nine vertical wires and reading upon the circle to 6″. With this instrument most of the latitude observations and the lunar culminations were taken, as well as the observations of the meridian passage of stars for rating the chronometers. (2) A transit theodolite, by Hurlimann, Paris, with 13-centimètre (5·1 inches) circles, reading to 30″ only, and fitted with long trough magnetic needles, of which four were taken. This instrument was used for secondary astronomical work, and for the determination of magnetic declinations. (3) Two marine chronometers, by Hohwü, Amsterdam, and a half-chronometer watch regulated to sidereal time, all of which appear to have given satisfaction. (4) A Delporte magnetometer, for the magnetic observations. (5) A George's mercurial barometer, by Cary, London, which was taken on the recommendation of Mr. J. Coles, the Society's late map curator and instructor in surveying. This instrument seems to have been previously unknown in Belgium, and as it appears to have answered Captain Lemaire's purpose well, and given good results, he devotes a considerable space to its description and use. The advantage of this form of mercurial barometer for the purposes of the explorer is that it is carried empty, and so much more safely than most other forms; but as considerable difficulty has often been experienced with the filling, especially on cold and exposed mountain-tops, it has lately rather fallen into disuse. However, the region over which Captain Lemaire passed was of no very great altitude, and as he evidently made himself thoroughly acquainted with the working of the instrument, and had it carefully tested before starting, it is not surprising that he obtained good results from it. In addition to the instruments already mentioned, there were two aneroids, a barograph, a hypsometrical apparatus, two pocket compasses, and two pedometers taken. A good telescope for observing occultations of stars might have been added with advantage.

Parts Nos. ii. to xv. contain, at the commencement, one or two pages of tabulated results, as in the first part, and then in the remaining pages of each an explanation of the observations and the computations upon which the results are based, the stars employed, the result arrived at from each separate observation, how far the results differ from one another and from the means adopted, and other matters that will be most interesting and useful to those who wish for further details than can be obtained from the general table of results. It is thus possible to judge of the relative value of the observations, and the amount of reliance to be placed upon them. For instance, it will be seen that the latitudes are arrived at from the mean of meridian zenith distances of stars taken north and south of the observer, and in some cases as many as twelve to twenty stars have been observed. In many instances the agreement between the separate observations and the results of the pairs is fairly good, but in others the differences are decidedly large, considering the size and character of the instrument generally employed.

As regards longitude, sixteen of the stations were fixed by the absolute method of lunar culminations observed with the transit instrument, which had been previously placed in the meridian, and the remainder by ordinary chronometric differences, the chronometers and half-chronometer watches being carefully rated. The observations and results of the computations for the rating are all tabulated in these memoirs. It is surprising that the longitudes were not determined

by occultations of stars wherever this was possible, for this observation has from experience been found to give the most satisfactory results of all absolute methods, and certainly might have been employed with advantage in conjunction with the lunar culmination method, as might also the usual moon-culminating star observation. However, as the mean of a considerable number of observations has been taken, it is possible that the resulting longitudes are not very much in error.

The last part, Memoir No. xvi., is entirely devoted to the determination of the altitudes, and, as previously stated, gives a revised table of results for all those observations taken between the months of August, 1898, and May, 1900. The difference between the figures given in this table and those which previously appear is generally very slight, but upon further consideration it has been thought necessary to apply a small correction. The altitudes were determined by the George's barometer and aneroids, checked by boiling-point thermometer-readings, no attempt being made at trigonometrical determinations. However, as care has evidently been taken with the readings and computations, and no great elevations were met with, the results ought to be very fairly correct. The formulæ employed in the computations of the altitudes are given. The first section of this latest published memoir, the substance of which was communicated to the *Société Belge d'Astronomie* at the meeting held on December 2, 1901, consists of a most interesting general discussion on the subject of the determination of altitudes, especially with reference to tropical Africa, and is accompanied by diagrams and tables showing the mean annual range of the barometer and thermometer at Daares-Salam, Kwai, Banana, and St. Paul de Loanda, as well as the variation for each month. Captain Lemaire comes to the conclusion that, as the variation of the barometer readings at sea-level in tropical Africa is so slight, and such changes as exist so regular and similar in places separated by great distances, it is possible to construct a table for tropical Africa upon the principle of that arranged by Delporte, with certain modifications, which shall give the altitude corresponding to any observed reading of the barometer and thermometer at a glance with sufficient accuracy for all practical purposes, having first allowed a correction for daily range, and thence obtained the mean annual reading for the place from tables which are given. At the end of the last part this general table for the determination of altitudes is given, and certainly a considerable saving of time and labour would be effected by its use, but the results can only be considered approximate, and for accurate work there is no doubt that the altitudes should be computed.

A map, showing the geographical results of Captain Lemaire's expedition on the scale of 1 : 1,000,000 (in two sheets), has already been published, but a complete atlas in 125 to 130 sheets, on the scale of 1 : 50,000, showing all details, is to appear in three parts, during this year and next. The first 28 sheets of this atlas were published a few weeks ago. E. A. R.

Again the Ophir Question.*

During his two years' travels (1899–1901) in the region south of the lower Zambezi, Dr. Peters, late of the German Colonial Service, visited several districts about the Anglo-Portuguese frontiers, with the twofold object of inquiring into their mineral resources on behalf of a London syndicate, and of making any fresh discoveries that might help to elucidate the perennial Ophir question. The results of both inquiries, with much additional matter dealing with the geographical features, climate, and ethnology of the parts visited, and the present economic

* 'The Eldorado of the Ancients.' By Dr. Carl Peters. 2 maps and 97 illustrations. Pearson : 1902.

relations and future prospects of the whole land between the Zambezi and the Limpopo, are embodied in this bulky and well-illustrated volume, which thus appeals to many tastes and many interests. Exploring work, with which we are here mainly concerned, was confined to Macombe's semi-independent territory in the Muïra valley below the Lupata gorge, the Rhodesian districts of Inyanga in the Ruenya basin, and Melsetter in the upper Sabi valley, and the intervening Portuguese province of Manica. From one of the accompanying maps, showing the routes followed through these tracts, it is at once seen that they comprise just those parts of the country which have been least, or not at all, included in the researches of the author's forerunners, Mauch, Bent, Baines, Hall, Neal, Johnson, and White. Hence our author's investigations are all the more welcome, since, as far as they go, they serve to complete the preliminary archæological survey of the whole region between the Transvaal and North Rhodesia—that is, the region of the Zimbabwes, terraces, chains of forts, slave-pits, gold and copper workings, and other remains of the old Himyaritic and Phœnician treasure-seekers.

The sum of these remains is not greatly increased by Dr. Peters' contributions, since little was found in the Muïra valley, and Manica was merely traversed, while the remarkable terraces of Inyanga were already known from Messrs. Hall and Neal's book, reviewed in the *Journal* for April, 1902. In fact, his chief discovery was the extensive copper-workings of Melsetter, extending over a distance of 25 miles, and associated with ruins of the Zimbabwe type. These are regarded as "the necessary complement to the gold-mines of Mashona- and Manica-lands." Yet, while the gold-workings and monuments are rightly assigned to the Semitic Himyarites, it is suggested that the Hamitic "Egyptians obtained the copper of their voyages to Punt" from the Melsetter mines. To understand this allusion, it should be stated that Dr. Peters, following the dangerous guidance of Dr. Glaser, gives a prodigious extension to the Egyptian Punt, which is made to embrace not only Yemen and Somali-land, but also Æthiopia, "with the Abasian colonies that extended beyond the Victoria Nyanza, the Azanian colonies, along the Zanzibar coast, the Sabæan dominions between the Zambesi and the Sabi, with Mashona-land and Manica, and doubtless Madagascar. All this was known to the Egyptians, and to the Egyptians only, as Punt." It follows that the Egyptians could go nowhere without going to Punt, so that the word becomes meaningless as a determinant of any particular expedition. But the Egyptian theory is supported by the Egyptian statuette, of which so much has been heard, and which is here again brought forward to fix the very spot near Tete on the Zambezi where the governor appointed by the Pharaoh "appears to have died and to have been buried." Yet Dr. Peters complains that in 'The Gold of Ophir' I make him aver that South Africa was "an ancient Egyptian settlement." I did so because he had already written to the *Times* (August 1, 1901) "that these mining districts were originally discovered by the Egyptians, *and were an Egyptian colony*."

However, despite all these Egyptian velleities, he frankly allows that "the mass of South African ruins is of ancient Semitic origin," and even claims to have always thought so "ever since Bent's expeditions." Thus the only real difference between us is that, while I hold Rhodesia to be the source, and Ophir the distributor, of the Solomonic gold, Dr. Peters thinks that Rhodesia was Ophir itself, that is, both the source and the distributor. In support of his contention he unfortunately revives some of his already discredited etymologies, such as Ophir = Afer = Africa, and also introduces others of an equally reckless character. Thus, "In the word '*Pun*-gwe' I recognize one of the philological evidences that this region once belonged to the Carthaginian [*sic*] dominions on the Indian Ocean specially indicated by Dr. Glaser, and called by the Egyptians Poenat, or Punt."

But it may be pointed out that the Carthaginians owned no land in the Indian ocean, and that here *Pung* is not *Punt*, but the root of the Bantu word *pungula*, "to pour out, to overflow," as the river in question does during the monsoons. So also the quite recent *Gaza* of Gazaland is the *Gaza* of Palestine; the Latin *Gallina afra* means "Ophir-hen," which "makes it a likely supposition that the guinea-fowl was known to the Carthaginians as the Ophir-fowl, and through these to the Romans." Then the M. *Fura* of an old French map becomes *Afur*, *Africa*, *Ophir*, but also "a mine," so that Ophir means both a whole continent and its underground treasures. Fura, however, I understand, locally means "water," whence, perhaps, Dr. Peters' failure, after a long quest, to rediscover "la grande montagne de Fura" of the French map. Lastly, the Punic migrations are carried beyond the Victoria Nyanza and Tanganyika to the upper Congo, where the ruling tribe of the "Ba-ima or Ba-'m is perhaps a corruption of Ba-Ma'in," the South Arabian Minæans. But the Ba-ima are the well-known Ba-Huma of Galla stock, who, like the late King Mtesa of Uganda, still often speak Galla, which is not a Minæan (Semitic) but a Hamitic language. To find any parallels to these strange etymologies, we must go back to the Phœnician king *Achis* of Gath, identified by Hitzig with the Homeric *Anchises*, father of Æneas by Venus; or Büttner's equation of the *zzar* in Nebuchadnez*zar* with the Russian *Tsar* (Cæsar). Dr. Peters may perhaps claim that he errs in good company, but not that he has advanced the Ophir question by these etymological vagaries.

A. H. Keane.

AMERICA.

Peruvian Antiquities.*

Herr A. Baessler, of Berlin, has lately returned from South America with perhaps the most extensive collection of old Peruvian industrial and artistic remains ever brought together by any single explorer in this apparently inexhaustible storehouse of American antiquities. The finds, numbering altogether over 11,500, were partly obtained by his own researches amid the pre-Columbian graves strewn over the Andean uplands, and partly by purchase from other collectors, amongst whom Mr. W. Gretzer, of Lima, calls for special mention. Everything has now been deposited in the Berlin Royal Museum of Ethnology, and from these rich materials Herr Baessler has made a selection for reproduction, with descriptive text, in a sumptuous work of four folio volumes, comprising 165 plain and coloured plates, with nearly 500 separate figures.

The work will be issued in fifteen parts, each consisting of eleven plates in portfolio, with accompanying explanatory text; and arrangements have been made for the completion of the whole within the year 1903. Vols. i. to iii. (Plates 1 to 130) will be occupied with the drawings and paintings, the scenes shown in relief and on the round, on North Peruvian earthenware, and will include specimens of ornamental motives, houses and temple pyramids, battle and festive scenes, social gatherings, mythical beings human and animal, inhabitants of the upper and underground worlds, and numerous other subjects illustrating the political and social relations, the religious and mental notions of pre-Columbian times. In vol. iv. (Plates 131–165) will be reproduced various pictorial scenes on earthenware from the central Pachacamac district, together with several specially selected specimens

* 'Ancient Peruvian Art: Contributions to the Archæology of the Empire of the Incas. Made from his collections by Arthur Baessler; translated by A. H. Keane. Part I. Asher: 1902.

from all parts of the empire of the Incas. Amongst these and the other objects chosen for comparative purposes are comprised crowns and sceptres, weights and scales, banners, bronzes, gold and silver vases, surgical instruments and dressing appliances, mummy-packs, feather-work, and such like characteristic specimens of the ancient Peruvian industrial arts. Reserving a detailed notice till the completion of the work, it will suffice here to state that, judging from Part i. already issued, 'Ancient Peruvian Art' promises to take its place, jointly with Reiss and Stübel's 'Necropolis of Ancon' and Tschudi's 'Historical and Linguistic Studies,' amongst the most indispensable contributions to our knowledge of the social life and general culture of the more advanced peoples of the New World. As was to be expected, Professor Keane's rendering of the German explanatory text is accurate, intelligent, and idiomatic.

The Amazon.*

The river Aquiri, or Acre, the principal tributary of the Purus, which is one of the main southern affluents of the Amazons, was first discovered in 1865 by our Gold Medallist, William Chandless, who thoroughly explored its course so far as it was navigable, and gave a most interesting account of its banks, their products, and inhabitants. He fixed twenty points by astronomical observations, and made a detailed map of the river (see *R.G.S. Journal*, vol. xxxvi. p. 119). Mr. Chandless reported that indiarubber trees of good size and quality were fairly common.

It appears that fifteen years after the discovery by Chandless, a number of colonists from the arid Brazilian province of Ceara arrived in the Acre, and established themselves at various points to work at the indiarubber industry. But the river is on the Bolivian side of the boundary agreed to between Brazil and Bolivia in 1867, and in January, 1899, Dr. Don José Paravicini, a Bolivian diplomatist, arrived in a river-steamer to establish a port which he named Port Acre. The river is here 70 yards broad, with impenetrable forest on its banks. In the following July the Brazilian settlers declared their independence, and elected a President, expelling the Bolivian garrison. In January, 1900, the Bolivians, under one Ibarra, arrived at Port Acre, but were repulsed, and their leader was mortally wounded.

A more important expedition was then organized in Bolivia, to restore order in the Acre region. It consisted of a force of 270 soldiers, under Colonel Ismael Montes, which left La Paz in June, 1900. The present work is a narrative of the proceedings of this expedition written by Don José Aguirre Acha, who accompanied it. The Brazilian Government remained neutral. The march was partly through dense forest, and the Bolivians appear to have encountered no ordinary difficulties. On reaching the river, there were several actions and some loss of life; but by January, 1901, the resistance of the Brazilian insurgents was overcome and peace was restored. Port Acre became the seat of government, the blockade was raised, and the export of indiarubber was recommenced. The Bolivians were wise in thus enforcing their sovereignty, for it is likely that in the near future Acre will become an important centre of the indiarubber trade.

In the last chapter there is an account of the steam navigation on the Amazons, and some interesting statistics.

C. R. M.

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* 'De las Andes al Amazonas Recuerdos de la campaña de Acre.' Por José Aguirre Acha. Pp. ix. and 273. La Paz: 1902.

THE MONTHLY RECORD.

EUROPE.

The Thames-Severn Divide Controversy.—Mr. Strahan, in a recent paper on the "Origin of the River System of South Wales, and its Connection with that of the Severn and the Thames" (see *Quart. Jour. Geological Soc.*, May, 1902, and note in *Geographical Journal* for July), asserted that the course of the Severn parallel to the Cotswold escarpment remained unexplained, and that "the theories put forward by Mr. S. S. Buckman, . . . following the lead of Prof. W. M. Davis," appeared to him "to transgress the limits of legitimate speculation." Mr. Buckman sends a vigorous reply to the August number of the *Geological Magazine*. Mr. Strahan's contention is that when the chalk covered the whole region, an anticline in a S.W.–N.E. direction (which he, Mr. Buckman, and others call Caledonian, to the confusion of our nomenclature) existed about the position of the present Thames-Severn divide, and accounts for the westerly deflection of the Severn. In support of this hypothesis, he stated that Mr. Buckman had recently found traces of an anticline in the vale of Moreton which might confirm his supposition. Mr. Buckman points out that the Moreton anticline has a N.–S. (so-called Malvernian) trend, and therefore has not the direction which Mr. Strahan requires; and, further, "it is not in the position that he wants, it is not where he has marked it on his map, and it does not coincide with the water-parting." If such an anticline as Mr. Strahan imagines existed, the Jurassic rocks would dip differently than they do west of the present escarpment; but the Jurassic rocks of the Severn valley dip persistently to the south-east, as do those of the Cotswolds. Moreover, "the tributaries on the left bank of the Severn-Avon have not the direction which his hypothesis requires; but they flow more or less against the direction of the Severn and Avon; . . . they diverge towards the main stream." This might be explained by radial drainage of a dome-like elevation, of which there is no trace here, or else by the hypothesis that the "tributaries of the Severn-Avon have worked back in and now occupy valleys which were originally marked out by streams that flowed in the opposite direction, namely, with the dip, before the Severn valley had been made, and these streams converged to join the Thames river system." Mr. Buckman asserts that this is the theory which Mr. Strahan declares passes the bounds of legitimate speculation. We imagine that Mr. Buckman's suggestive but very hypothetical map, rather than Mr. Buckman's or Prof. Davis's papers, were in Mr. Strahan's mind when he penned his somewhat malicious strictures. The most suggestive part of Mr. Buckman's paper is not its destructive criticism, but the working out of the drainage lines resulting from the intersection of a south-dipping N.–S. and an east-dipping W.–E. (so-called Malvernian and Armorican) anticlinal axis. From the east of the south-dipping Welsh backbone the streams would run obliquely, *i.e.* south-east, or at right angles to the S.W.–N.E. strike. From the north of the east-dipping Mendip-Pewsey axis, the streams would run north-eastwards. The two series of dip-streams would meet in the synclinal trough, the Kennet-Thames trough. The next stage is the differential denudation on the older rocks after the surface covering has been worn away, when strike streams develop in the softer outcrops, and their growth results in river captures. In the third stage, rivers working back against the dip are started in the valleys of beheaded dip-streams; so breached escarpments with valley water-partings are formed. Mr. Buckman maintains that this is a more rational theory, and one whose principles can be applied to all river-systems, whereas Mr. Strahan's only meets an isolated case, or requires an anticline to account for every strike-stream and for every water-parting which happens to coincide with an escarpment.

Prehistoric Man and the Glacial Epoch in the Alps.—Prof. Penck, of Vienna, lectured to the recent congress of naturalists and physicians at Karlsbad on the glacial epoch in the Alps and its relation to prehistoric Man. He described the results of researches by Prof. Brückner and himself, showing that the glacial period in the Alps was characterized by major and minor variations of climate. Four distinct glacial periods have been recognized, separated by three interglacial intervals, and after the last ice period three glacial "stages." Bringing this time-succession into relation with the traces of prehistoric man, it appears that the latest prehistoric records are later than the last of the glacial "stages," while the older stone periods coincide with the glacial period proper. The latest section of the older stone periods, the Magdalenian, is later than the last ice period, but the Mousterian is older than it, corresponding to the last interglacial period. The oldest division of palæolithic time corresponds to one of the two interglacial periods. Hence it follows that de Mortillet's division of palæolithic time, based on the evidence of progressive improvement in stone implements, really separates from one another different phases of a development which was spread over a long time, and that the older stone age was incomparably longer than the more recent. The stone age included the greater part of the glacial epoch, the duration of which must have been at least 500,000 years. It appears, further, that the interval between the older and the more recent stone periods must have been of but short duration; indeed, new finds tend to fill up this interval more and more. Henceforth we must think of an advance of neolithic culture rather than of an immigration of neolithic peoples, and, in the light of modern knowledge, must regard Europe as the scene of an ancient civilization which had its beginnings several thousand centuries ago.

Results of Boring in the Hintereisferner (Tirol).—The problem of piercing a glacier by means of boring has at last been solved, with results of undoubted scientific interest. During August last the Bavarian scientists Blümcke and Hess succeeded in making a number of borings in the Hintereisferner, in the Ötzthaler Alps, above Vent. At a distance of about one and a quarter mile from the tip of the glacier, where its breadth is 2130 feet, and the height of its surface above sea-level 8530 feet, a boring in the middle reached the rock at a depth of 500 feet. The apparatus employed was similar to that used in mines for trial borings; it was worked by hand, and had special arrangements for washing out the borings with water so as to prevent their freezing in again. The formation of cracks and fissures seriously interfered with the washing out, but the difficulty was got over by lining the upper 80 feet of the bore with steel tubes. Taken along with measurements of rate of movement, surface melting, and temperature observations, the boring operations have enabled the following conclusions to be drawn: (1) The temperature of the ice is at the melting-point throughout the whole mass of the tongue of the glacier; (2) the bed of the glacier is trough-shaped; and (3) the ice moves more slowly along the bottom than at the surface. The last fact, now definitely established by direct observation, has been disputed by E. von Drygalski. The bore-holes were, as formerly, filled up with pieces of wood, which will serve for many years to come as measures of the rates of movement and surface melting. The cost of the work has been borne by the German and Austrian Alpenverein.

Geological Structure of Sardinia.—Prof. A. Tornquist, of Strassburg, has lately undertaken a journey of geological research in the Western Mediterranean, with the support of the Prussian Academy of Sciences. The region first visited was the island of Sardinia, of the geology of which our knowledge has hitherto been very imperfect, and the preliminary results of the journey were put before the Academy at its meeting of July 10 last (*Sitzungsberichte*, vol. 35, p. 808

et seq.). Prof. Tornquist's primary object was the investigation of the Trias of the Western Mediterranean, and as this formation had been reported to exist in four different parts of Sardinia, he was led to visit the greater part of the island, and was able to collect data on its general geological structure. The Trias was found to be less extensively developed than had been supposed, being present only on the west side of the island, in the Iglesiente, and its natural continuation, the Nurra di Sassari. As in Central Europe, the alpine and extra-alpine facies of the Trias are divided in this region by a broad zone, which follows the major axis of Sardinia, passing northwards towards the west side of Corsica, where the alpine facies, absent in the larger island, occurs in the east. From a structural point of view, Western Sardinia shows an equal contrast with the centre and east, being the only part in which the cretaceous system of folds is developed. Between the two regions there is a zone of depression, in which the traces of recent volcanic action are localized. The structure of the island thus forms a striking example of the way in which one and the same zone has served, ever since palæozoic times, to separate regions of entirely different geological action. It also presents many analogies with the geological conditions of Central Europe, the central zone corresponding in many ways with the tableland of Switzerland and Southern Bavaria, whilst the western folded range is homologous with the folded Jura in Central Europe.

Glaciated and Non-glaciated Regions in Russia.—The contrast between the topography of the glaciated and non-glaciated regions in Russia is perhaps best studied in the Volga heights, the eastern half of which has not been covered with ice. Mr. Bertrand gives a brief account of this region in the *Bull. de la Soc. Belge de Géol.*, vol. 15, 1901. He sees in the gradual rise of level from 190 metres in the north to 200 metres in the south of the western glaciated region evidence for the thinning of, and consequently for diminished erosion under, the ice-sheet; for in the non-glaciated east the highest point (250 metres) lies halfway between north and south and decreases in the direction of the valley-lines. In the east, Tertiary deposits exist on the top of the heights, are thickest at the centre, thin off towards the periphery, and are completely worn away in the valley. From the western part the Tertiary rocks have disappeared, except in the extreme east and south-east. Along the Isna valley, the axis of the Oka-Don ice-flow, erosion has been greatest, and on the margins and at the end it has been least, where the ice was thinnest and covered the ground for the shortest time.

Kertch and the Azov Trade.—The difficulties of the Kertch straits have always affected the trade of the Sea of Azov, and the report of the British Consul at that town calls attention to the various projects now under consideration for the improvement of the present condition of affairs. One plan is for the dredging of the straits to a uniform depth of 25 feet, and the construction of ports capable of receiving ocean-going steamers at the various towns in the Azov sea, by which means ships could be able to load a full cargo at Taganrog, Mariupol, etc., and pass through Kertch straits without stopping. Another project would cease dredging the straits altogether, making Kertch an extensive deep-water port of the first class, and carrying on the sea of Azov trade by means of smaller coasting vessels. The first plan, it is stated, would necessitate enormous outlay, with constant expense for dredging. The latter would be the more feasible, and though at present Kertch has no accommodation for shipping, there is no reason why it should not become one of the most important towns in South Russia. It possesses an unlimited quantity of rich iron ore, and salt lakes capable of turning out 50,000 tons yearly, in addition to rich fisheries and oyster-beds, and recently powerful naphtha springs have been discovered. Another project which has been set on foot is one

for the closing of the straits by means of a dam with locks, so as to raise the level of the sea of Azov and make it accessible for larger vessels.

The Forests of Rumania.—The increasing export of timber from Galatz, due to the action of the Rumanian Government in reducing the railway tariffs for the conveyance of wood, is remarkable. The timber trade has now practically deserted Odessa for this port, and nearly 319,000 tons were exported last year. The forests of Roumania cover about one-sixth of the total area of the country, and reach a total of some 7,000,000 acres, of which about one-half is owned by the State and by public establishments and communes, and the rest by private individuals. Of the different forests, those of beech are the most valuable, followed by those of the various kinds of oak. From the latter were obtained the sleepers for the Congo railways. After these in relative degree of value come pitch pine, fir, lime, elm, ash, and plane. The consular report (Annual Ser., No. 2874, 1902) states that, while the forests of the peasant proprietors and small holders have been practically destroyed by wholesale cutting, those of the State are in good condition and are now managed with care.

ASIA.

Scientific Results of Dr. Sven Hedin's Last Expedition.—A letter has been addressed by Dr. Sven Hedin to the King of Sweden, in which the traveller submits a proposal for the publication of the scientific results of his latest expedition under the auspices of the Swedish Government, a proposal which, it is hoped, will be received favourably. After summarizing the geographical and other work accomplished during the last three years, and quoting opinions which have been expressed in the *Journal* and elsewhere, as to the importance of the publication in full of the extensive material collected, Dr. Hedin develops his plan as follows: "The cartographical material should be worked up at the Lithographical Department of the General Staff in Stockholm, under the supervision of Captain H. Byström and myself. It should be reduced to the scale of 1 : 200,000, and be published in an atlas of two volumes containing 100 sheets of large size, with introduction, letterpress to each sheet, and astronomical points. According to an estimate made at the G.L.A., this atlas would involve an expenditure of 40,000 kr. (about £2200). The cost of working through the meteorological journals and of their publication, with the necessary charts of atmospheric pressure over the interior of Asia, is reckoned by Dr. Nils Ekholm at 5000 kr. (£280), including the expense of copying contemporary observations recorded at several stations in South Siberia and Northern India, fees to assistants, providing an instrument for transferring barogram and thermogram records to tables, etc. The 113 series of astronomical observations to determine points will demand for reduction and publication a sum of 3000 kr. (£166), according to Prof. P. J. Rosén. The zoological, botanical, and archæological reports will require 2000 kr. (£110) each, according to the estimate of Profs. Leche and Lagerheim, and the sinologist, K. Himly, of Wiesbaden. The geological work will, H. Bäckström states, require 15 sheets of text, 10 plates, and 2 geological maps, and will cost 5000 kr. There remains the purely geographical report, which I have myself reckoned out at 100 sheets of text, with 30 coloured maps (not included in the atlas), and 500 illustrations in the text. It will cost 1600 kr. (£890) to publish. Hence it appears that the publication will altogether entail an expenditure of 75,000 kr. (about £4170). Evidently, in consequence of the heavy expense and the small sale that may be expected of a purely scientific work, no private publisher can undertake the publication. . . . The popular narrative of travel I am in the mean time preparing for publication will doubtless procure me a return, but I would at the same time point out that my expedition in Asia cost me personally 40,000 kr.,

in addition to the liberal contributions I received from your Majesty, as well as from Swedes interested in geographical exploration, especially E. Nobel. Under these circumstances, and knowing the liberality with which the Government and Parliament support Swedish research, I venture humbly to entreat that your Majesty will graciously submit to the Parliament now about to meet a proposal to grant a subsidy for the publication of the scientific results amounting to 75,000 kr., to be spread over three years, commencing with the year 1903."

Dr. and Mrs. Workman in the Karakoram.*—Dr. William Hunter Workman and Mrs. Fanny Bullock Workman have returned to India after their third expedition among the higher Karakoram mountains. They devoted their attention chiefly to the Chogo Lungma glacier, which they explored throughout its entire length, from Arandu to its point of origin some 30 miles to the north-west. They also explored three large tributary terminal glaciers, which are important feeders of the main trunk. Some forty years ago Colonel H. H. Godwin Austen surveyed the lower part of the Chogo Lungma, but the upper part has never before been visited, and the map at this part was found wholly incorrect. The Chogo Lungma takes its rise in a steep snow wall or col about 20,000 feet in altitude, which connects two lofty peaks, one of which is fixed by the Indian Survey at 24,486 feet, and the other cannot be much lower. Several other magnificent peaks of nearly the same altitude send down large glaciers to help form the Chogo Lungma. One of the tributary glaciers brought the explorers under the northern flank of Mount Haramosh (24,285 feet), to a broad snow-pass at a height of 17,500 feet, from which another glacier plunges sharply down to the west into a deep valley, whence, by crossing a lower ridge at 15,000 feet, Gilgit can be reached. This pass could never have any military importance, as it and its approaches lie in a region in the highest degree alpine, which no army could ever cross. The surface of the Chogo Lungma is irregular, being at some points considerably depressed, and at others much raised above the general level. It is in many places seamed by crevasses extending in all directions, and the resulting *séracs*, some of them of vast dimensions with their environing abysses, form labyrinths through which a path is extremely difficult to find. The tributary glaciers are nearly all broken at different places in their course into impassable ice-falls. The Chogo Lungma has evidently receded greatly in recent years, both at the snout and along its course. For long distances vast lateral moraines tower far above the present level of the ice, completely shutting out all view of it from one walking along the bases of the mountains that skirt the glacier. The glacier bears large medial moraines in places 80 to 100 feet high, which enter it from the terminal branches. At the entrance of the Haramosh arm a deep depression in the surface is occupied by a good-sized lake. Much soft snow was encountered at the upper parts near the origin of the main glacier and those of its branches. The depth at one place measured 85 centimetres (2 feet 9 inches), which was about the average depth over a considerable distance. Many days and nights were passed at snow camps at altitudes of from 16,000 to over 19,000 feet. Four peaks and two cols were ascended. Several rock cairns were built at points where materials were to be had, in which records were deposited. The weather was unfavourable for mountain work, being uncertain or stormy most of the time. The party was detained at one high camp for sixty hours by a severe snowstorm. Thanks are due to the British authorities at Srinagar for their courteous aid in obtaining transport, and also to H.H. the Maharaja of Kashmir and his brother Sir Amar Singh, who took a most friendly interest in the expedition, and issued orders to all officials along the route to

* Communicated by Dr. W. Hunter Workman.

promptly furnish coolies and supplies, and render any other assistance needful. A large number of photographs were taken. Dr. Karl Oestreich, of Frankfurt, accompanied the expedition as topographer, and Mattia Zurbriggen and Müller Giuseppe as guides. Most of the altitudes given above are to be regarded as only approximate, subject to correction when comparison shall have been made with the readings at the lower station.

The Saposhnikof-Friederichsen Expedition to the Tian Shan.—We have been favoured by the Hamburg Geographical Society with a copy of a letter addressed to the Society by Dr. Max Friederiscbsen, announcing the return to Lepzinsk, in the Semiretchesk Government, of the expedition to the Tian Shan undertaken by him, as announced in the *Journal* for June last, in company with the Russian botanist Saposhnikof. Although attended with some dangers and hardships, the expedition had been most successful from a scientific point of view, valuable results having been obtained, not only in the Tian Shan itself, but during the return journey from Charkent through the Dzungarian Alatau, many of the valleys in which had never before been scientifically explored. Dr. Friederichsen's route survey and the theodolite observations, determinations of altitude and photographs taken by the expedition, will supply entirely new material respecting the morphology of the range. During this part of the journey bad weather, with snowfalls and nightly frosts, was experienced, and caused the travellers much discomfort in the tents which were their only shelters. An attack was made upon the party by nomad Kirghiz, but friendship was soon established. At the date of writing (August 29), Dr. Friederichsen was about to start with his Russian companion *viâ* Sergiopol for Kakpekti, in order to examine a mammoth *in situ*, and was then to proceed *viâ* Semipalatinsk to Omsk, where he expected to make some stay, returning to Europe early in October.

Recent Progress in Formosa.—The Rev. W. Campbell, who for many years has worked as a missionary in Formosa, sends us some notes on the additions to our knowledge of the island and the improvements in its material welfare, which have been made under Japanese administration. From the latter point of view, much has been done in the construction of roads, tramways, and railways, and the establishment of stations for administrative and scientific purposes. These improvements were preceded by detailed inquiries regarding the population and topography of the island. The work of the census alone occupied about two years, and the resulting information has been stored up in government publications of much value. Maps of the island have been prepared, one on the scale of 1 : 200,000, based on the British Admiralty chart, but giving both a fuller delineation of the coast-line and many additional details respecting the interior; the other, on half the scale (1 : 400,000 or 6·3 stat. miles to the inch), but even fuller, and only to be replaced when the labours of the present survey commission are completed, about three years hence. Scientific contributions to our knowledge of Formosa have been made by Prof. Honda, whose expedition to Mount Morrison * in 1896 was described in the *Journal* for January, 1898 (vol. xi. p. 68), by Dr. Ishii, whose geological papers in the *Journal* of the Tokyo Geographical Society have shed a flood of light on the physical geography and river systems of Formosa; and by Mr. Miyake, whose botanical collections include 23,000 specimens, many of them from the seldom-visited island of Botel Tobago. Mention should also be made of the *Monthly Journal* of the Formosan Association, which is a mine of trustworthy information on everything relating to the island. It is only to be regretted, Mr. Campbell says, that

* So named by the late Captain Collinson after the pioneer Protestant missionary to China (*vide P.R.G.S.*, vol. viii., 1864, p. 25).

so many of these substantial contributions to the general stock of knowledge should be available only to those familiar with the written form of the Japanese language, and the establishment by the Government of a small translation bureau is very desirable. Lastly, one of the many important undertakings for which outsiders are indebted to Japan is the lighthouse now nearing completion on North island of the Pescadores group, in the neighbourhood of which there have been about thirty wrecks within as many years, including that of the P. and O. liner *Bokhara* in 1892. Mr. Campbell concludes with some remarks on the need for reform in the methods in use for the writing of native names in Roman letters, in regard to which things are constantly drifting into worse confusion. European writers, *e.g.*, often spell the names, not as they are locally pronounced, but according to the sounds of the so-called mandarin dialect. Thus the British Admiralty chart has Fung-Shau for Hong-Soa, Pong-hou for Phe-aw, etc., etc. On the other hand, the missionaries have prepared an extensive literature in Roman letters for the ten millions of people who speak the same form of Chinese in Formosa and the opposite mainland, every form of local speech being represented by the use of tonal and other diacritic marks; while the Japanese educational and telegraph departments both employ divergent methods from either of the above, and have also replaced many of the native names by Japanese ones. The requirements of the case seem to be as follows: The correct pronunciation, as seen in Roman letter-books in use among the natives, must be taken as the basis; but for all outside purposes a simple method of spelling, in which redundant letters and unusual signs are omitted, should be adopted. Tables should be drawn up showing the two spellings of each name side by side. Attention to the R.G.S. rules on the subject of place-names would both add to the convenience of the people, and would eliminate mistakes and enable westerners to follow the course of events in the island with much more intelligence.

Railway Development in Formosa.—The projected main line which is to extend from Kelung to the south of the island of Formosa is progressing rapidly. Of the northern section, 63 miles are already completed, the considerable town of Shinchiku being now reached. In the south the line from Takou has been finished, and is open for traffic as far north as Kagi, a distance of 67 miles, and Tarimu, some 15 miles further north, will be reached by the end of the year, by which time another 21 miles will be added from Shinchiku. This makes a total of 166 miles, and another small line of 13 miles in length connects Tamsui with the capital Taipe, or, as it is now called, Taihoku. The nomenclature of other places has been changed, and Twatutia, the chief resort of the foreign merchants, is now known as Daidotei (F.O. Reports, Annual No. 2869, 1902).

AFRICA.

Further Discoveries at Zimbabwe.—Mr. R. N. Hall—well known as the joint author with Mr. Neal of the important work on the ancient ruins in Rhodesia reviewed in the *Journal* for April last—who has been commissioned by the Government of South Rhodesia to take steps for the preservation of the ruins at Zimbabwe, has already done some important work in the way of clearing the remains from rubbish and vegetation, so as not only to arrest their destruction, but to bring to light various hitherto undiscovered features. Some details respecting these are given in the *Scotsman* for September 27 last. The "acropolis" at Zimbabwe stands on a kopje 250 feet above the plain, and on the slopes of this walls enclosing passages winding up towards the summit have been laid bare, while other hitherto unknown passages have been found, as well as two large ancient entrances, a wall with dentelle pattern, a cement-lined enclosure, and three wedge-shaped

buttresses, the last-named being of special interest as the first buttresses discovered in Rhodesia. The objects unearthed from the rubbish include the usual soapstone birds, beams and bowls, pottery and iron tools, and a gold bangle of wirework weighing 3½ ozs. Much has also been done for the preservation of the elliptical temple situated on the plain below the acropolis. The jungle with which it was entirely filled, and which was causing much damage to the ruins, has been cleared away, and an uninterrupted view of the structure, with its conical tower suggestive of the ancient phallic worship, can now be obtained. Other discoveries made here are four ancient drains, a double-curved entrance, three sets of stone steps, and several yards of cement flooring, which, however, as is the case with some of the upper parts of the walls, is a subsequent addition to the original structure. Among the objects found is a section of an ancient bowl believed to be the missing portion of the large bowl sent by Mr. Rhodes to the Cape Town Museum.

Captain Loefler's Surveys in the Shari Basin.—More than a year ago we announced the departure of an expedition under Captain Loefler for the exploration of the country traversed by the Logone, the important tributary of the Shari from the south-west. Captain Loefler has now returned after successfully accomplishing his object, and has given an account of his journey to a meeting of the Comité de l'Afrique Française, which is printed in the sixth number for the present year of the *Renseignements Coloniaux*, issued by that body. Both on the outward and return routes the traveller covered a large amount of new ground in the least-known part of the Shari basin. From Carnot on the upper Sanga, which was left in January, 1901, the route led north to Bam, occupying a commanding position near the meeting-point of the Sanga, Ubangi, and Shari basins, and thence north-east across the Wam, Captain Loefler's first object being to explore a direct route from the upper Sanga to the Shari. Beyond the Wam he passed through a broken country in which the granite rocks took various fantastic shapes, and afterwards descended to a plain watered by the Ba Ria and Ba Bo streams, which, after uniting, enter the Bahr Sara in about 9° N. The route led through the country of the Laka, a tribe which impressed the traveller by its splendid physique. Among them were seen the first horses met with on coming from the south. Between the Ba Bo and the Shari, which was struck at Kuno just south of 10° N., various depressions were traversed, which are evidently inundated during the rains, and then form a connection between the Bahr Sara and the Logone. At the time of Captain Loefler's passage the inhabitants depended solely on wells for their water-supply. As it proved impracticable to strike due west for the Logone, the party descended the Shari to Manjafa in about 11° N., and thence crossed over to the tributary, which was ascended for some 50 miles. The whole lower course of the Logone has recently been surveyed by Lieut. Kieffer, who found it navigable from its mouth to Lai, the crossing-place of Maistre in 1893. It was left at Safusu, somewhat to the north of 10°, the expedition then striking south-west towards the upper Benue, with a view to investigating the rumoured connection between the Shari and Benue, which has been a subject of discussion since Barth's time, no traveller having been able to follow the channel throughout its whole length. Captain Loefler traced it to Bifara, on the Mayo Kebbi, the furthest point on that river reached by Sir Claude Macdonald when attempting its ascent from the Benue. He has proved that a continuous depression exists between the Logone and the Benue, occupied in the dry season by a series of swamps and lakes, but affording a through water communication in the rains, when it is filled by the flood-water of the Logone. At that season there is, therefore, direct communication between the sea and Lake Chad. The return journey was made by a direct route along the Kamerun frontier and across the upper basin of the Logone, various branches of

which were crossed between 8° and 6½° N. The principal branch, the Ba, was a fine stream, 90 yards wide and 6 feet deep, with a strong current. The Wam was re-crossed some 40 miles from its source, and south of it a rocky district was traversed, in which there are caverns capable of giving shelter to whole villages.

The German Expedition to Lake Chad.—The *Deutsches Kolonialblatt* for September 15 announces the return to the coast of Lieut.-Colonel Pavel, the leader of the German expedition which set out for Lake Chad early in the present year. The expedition left Garua, on the upper Berne, on March 26, and, after crossing the Ngollo and Lebeleba ranges in spite of armed resistance, reached Dikoa, Rabah's late capital, on April 21, and the lake on May 3. A French force was found at Dikoa, but it retired into French territory on the hoisting of the German flag, and a German garrison was left at the place when the main expedition started homewards. The return route led along the Logone to Karnak Logone, and thence *viâ* Marua to Garua, where again a garrison was left, so that German authority is considered to be at last established in the northern Hinterland of the Kamerun. Sultan Suberu of Yola was twice defeated among the spurs of the Mandara mountains, but managed to escape capture. A complaint is made that the proceedings of the British in Bornu are preventing caravans from entering German territory.

Aldabra as a Type of Limestone Reef Formation.—Prof. A. Voeltzkow, of Strassburg, who has for some time been publishing the results of his scientific journeys on the islands and mainland of East Africa in the *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, has lately put forward his views as to the formation of Aldabra island (on which he spent a month), and of limestone reefs or banks in general (vol. xxvi. part 4 of the publication referred to—Frankfurt-a.-M., 1901). Aldabra presents at first sight the usual characters of an atoll, consisting as it does of a ring of land, divided into three islands by passages leading into a central lagoon. But a closer inspection shows that the land-ring is composed of a remarkably homogeneous white limestone, from which coral *débris* and coral sand are entirely absent. Specimens brought home by the writer have been carefully examined microscopically, and have, he thinks, thrown some light on the composition and structure of limestone reefs in general, to a consideration of which the first part of the paper is devoted. Prof. Voeltzkow discusses fully the organisms known as coccoliths and rhabdoliths, which in his opinion play a part in the formation of compact reef limestone similar to that played by foraminiferæ in the formation of chalk, etc. He considers them not as the dead fragments of more complex organisms, but rather as independent organisms to be regarded as the primordial or embryonal cells of the more developed structures; and instead of classing them, with Murray, among the algæ, is inclined to place them near the foraminiferæ. He likewise holds that the organisms are not pelagic, but live near the coasts and sea-bottoms, and that this is the reason why the deposits formed of their remains are not widely distributed, but of local occurrence. In the second part of the paper a detailed description is given (with map) of the structure and the general features of Aldabra, with notes on other limestone deposits of a similar nature occurring in Madagascar and elsewhere in the Indian ocean. The outer margin of the islands falls everywhere steeply to the sea, being often undercut, so that the casting up of coral *débris* by the waves would be an impossibility. In the lagoon there are mushroom-shaped islands, evidently the remnants of a once continuous bank, the formation of the lagoon being of comparatively recent date. The surface of the limestone has been hardened by atmospheric influences, and, apart from the dunes on the south coast, is almost devoid of the products of disintegration. Like other islands of the western Indian ocean, Aldabra rises from the sunken remains of an old continent, though in recent times a certain

elevatory movement is traceable. Lying exposed to the full force of the trade wind drift, which here flows constantly westward, the elevatory movement must have been rapid enough to counteract the effects of abrasion until the bank had been raised, by the deposit of organic remains above alluded to, to a height at which reef-building corals could thrive. The effect of the current is to be seen in the form of the island—elongated in the direction of its flow—the growth of coral being limited to the exposed side, while sediment is deposited on the lee side. The general conclusion is that Aldabra is an old limestone reef, formed by the action of minute organisms, and deposited on a bank which has apparently not been affected by tectonic disturbances. Whether deposited on a level platform or on the summit of a submarine peak, the thickness of the limestone appears to be very considerable.

Navigation of the Zambezi.—The Foreign Office report (Annual No. 2861, 1902) on the trade of Chinde furnishes details of the present condition of the Zambezi traffic. The river from January to August is navigable for stern-wheel or other shallow-draught steamers from the sea to Tete, and thence to the foot of the Kebrabasa rapids, a distance of over 400 miles. Above the rapids it is again navigable for steamers to Zumbo, or even beyond, and a barge service is already established, while the African Lakes Corporation will place a steamer on this section before the end of this year. A narrow-gauge railway round the rapids will complete the chain, and the money for its construction is already subscribed. The route when complete will bring the East Coast in direct communication with the Cape by means of the Trans-continental railway, and will open up an enormous area for trade. No less than four companies run steamers on the lower Zambezi from the mouth to Tete, and it is stated that the service is likely to increase, as the development of the territories to the north proceeds apace. Tete is regarded as a convenient depôt for the transshipment of goods to countries lying far west of Lake Nyasa, which are not easily reached by the lake route.

Tripoli and the Hinterland Trade-routes.—Mr. Consul-General Jago communicates to the Foreign Office a summary of the trade and development of Tripoli during the last forty years (Misc. Ser. No. 578, 1902). In the early seventies a sudden and great development of the caravan trade with Central Africa took place, and the combined exports and imports, which in the decennium 1862–71 amounted to less than £2,000,000, exceeded £8,000,000 in 1872–81. The pioneers of this trade were the merchants of Ghadames, who periodically sent goods to their agents in Ghât, Kanem, Bornu, Kano, and Timbuktu, receiving ostrich feathers, ivory, and gold-dust in exchange. In 1873 the Tripoli merchants began to compete with them by sending caravans to the Central and Western Sudan, but in 1893 Rabah's invasion of Bornu, which was the chief interior market, involved the destruction of the Tripoli caravans, and has since closed the traffic entirely. The traders had then to fall back on Kano and Wadai, the trade with the latter passing principally *viâ* Benghazi, but tribal disturbances from 1895 up to last year again led to constant caravan pillaging, and last year's consignments of goods for Kano are only now beginning to start on receipt of better news as to the security of the roads. The caravan journey out and home occupies about eighteen months, and the profits are said to be 50 per cent. on the outlay, but the merchants foresee most clearly the future divergence of Central African trade to the waterways of the Benue and the Niger.

AMERICA.

Colonel Glazier's Expedition to Labrador.—Colonel Willard Glazier has, during the past summer, taken a party from the United States for the purpose of exploration on the east coast of Labrador. A short account of

the trip appeared in the *Boston Evening Transcript* for September 10. The expedition included, in all, ten members, seven of whom were young men from Harvard, Boston, and other American universities, the remaining two (in addition to the leader) being Captain Perrigo and Lieut. Clark, the latter of whom had been with Peary in the north. It had been intended to start inland from Hamilton inlet, but as Eskimo were not to be had there, it was found necessary to go north to the Moravian Mission Station of Nain, in about 56½° N. The bay on which the station stands was followed upwards for some distance, when a fine river was discovered. It is said to be about 135 miles long, and to flow through a chain of seven lakes, the largest 40 miles long, and bounded by precipitous mountains, 1000 to 2000 feet above it, whence many cascades fall into it. The lakes are connected by rapids. After returning to Nain, the expedition went further north to Okak bay, the site of another mission station, whence the North river was ascended. The interior of the country was found to be totally devoid of human inhabitants, being bleak and desolate, with no vegetation but a few spruce and larch trees, and some alders and wild grasses. Caribou are in abundance, and are hunted by the Eskimo, while the bays and rivers abound in seals and fish. The commonest minerals are iron ore, copper, mica, and Labradorite. Collections were made of the birds, plants, the implements, etc., of the Eskimo, and of geological specimens. The party was cordially received by the missionaries, who are of German origin, and have done much to elevate the natives, while not interfering with their dress and mode of living. They have been established on the coast for about 150 years.

Exploration in Alaska.—The October number of the *National Geographic Magazine* reports the successful conclusion of the Geological Survey Expedition under Dr. A. H. Brooks, to which reference was made in the *Journal* a few months back. The route, which left the coast at Cook inlet, skirted the base of Mount McKinley, the highest known point of North America, and was continued to the Tanana. The full report on the journey, which led through the least-known part of Alaska, will be awaited with interest.

A Regional Study in Idaho.—In Nos. 53 and 54 of the "Water-Supply and Irrigation Papers," issued by the United States Department of the Interior (Washington, 1901), Prof. Israel C. Russell gives an admirable study in regional geography, in which not merely the physical features of the district, but the influence which these have in determining economic possibilities, are clearly brought out. The district dealt with is the Nez Perce county, in the south-west of Idaho, which was examined by the writer in 1900 with special reference to the possibilities of obtaining artesian water, the comparative smallness of the available water-supply being a serious matter in a country otherwise highly favoured by soil and climatic conditions, and even under existing circumstances producing a large amount of wheat. The main rivers, such as the Snake, Salmon, and others, flow in deep cañons, and, though copious, are in general unavailable for economic purposes, while, except on the higher plateaus, the rainfall is but meagre. Geologically, the region may be divided into an older and younger group of rocks, the former (probably pre-Tertiary) being of very varying character, while the latter consists principally of basalt (with interbedded layers of clay, sand, gravel, etc.), derived from the great Columbia river lava-flow, the products of disintegration of which constitute a soil of remarkable fertility. It is to the second group that the possibilities of obtaining an artesian water-supply are limited. The older rocks have been in part exposed by denudation (as *e.g.* at the base of the cañons), but in part rise as island-like areas ("steptoes") in a sea of lava, the surface having been deeply eroded before the latter was poured out. A large part of the plateaus

formed by the younger group are essentially horizontal, although there is evidence of a general subsidence to the extent of perhaps 1000 feet. Elsewhere, however, the sheets have been tilted and the extent of differential movement may be tested by comparison with the horizonal Uniontown plateau, which may be taken as a datum plane. Of the present surface features, one series owes its origin to such tilting of the lava-sheets, which have produced sharp folds along certain lines, while in the Blue hills a dome-shaped uplift has been formed. A second class of leading features is due to erosion, portions of the original plateau being separated by deep cañons, which may either have been cut by "antecedent" or "consequent" streams. The courses of the former (which include the Snake, Salmon, and Clearwater) are to a great extent independent, either of the structure of the rocks or of the larger features of surface relief. Among the minor topographic features are stream-terraces, land-slides, solution-basins, and the undulations of the level plateaus, originally no doubt due to stream action, though now no water flows on the surface. In the second part of the paper, Prof. Russell discusses the possible improvement of the water-supply in the lava-covered area, either by means of horizontal wells or tunnels, for which the conditions seem specially promising in parts, or by the sinking of artesian wells. The fact that the lava was poured out in successive sheets, between which beds of clay, sand, gravel, volcanic dust, etc., occur, supplies conditions favourable to the existence of water under pressure, and a certain measure of success has already been obtained at the Dowd wells in the Lewiston-Clarkson Basin. Another basin where the required conditions may exist is that lying between Craig mountain and the foothills of the Bitterroot mountains. Some notes are also given on the economic geology of the region, it being pointed out that the older formations supply building-stone, gold, and ores of various metals, while lignite has been discovered in the sedimentary beds interstratified with the lava.

Recent Elevation of the Coast of the Gulf of Mexico.—Mr. T. W. Vaughan writes to *Science* (September 26, 1902) to the effect that, while doing field work along the shore of the Gulf of Mexico, south of Tallahassee, Florida, he last spring obtained information tending to prove that the coast in that vicinity has been perceptibly elevated within the memory of man. At St. Mark's, in Wakulla country, there is an old house built on piles, beneath which the water at high tide formerly passed into a pond in the field beyond. This is now no longer the case at spring tide, unless a strong south-east or south wind has been blowing for two or more days. A neap tide does not approach within 300 yards of the site of the pond. The elevation since the "fifties" is estimated at from 1 foot to 18 inches, or from 2 to 3 feet per century. This conclusion is in harmony with facts regarding the coast region of Texas lately brought to notice by Mr. R. T. Hill (cf. *Journal*, vol. xix. p. 402).

The Coal-beds of America.—A special report (Misc. Ser. No.580, 1902) on the coal industry of the consular district of Chicago has lately been issued by the Foreign Office, which shows roughly the amount of coal available for manufactures and railways in a great commercial area with undeveloped resources. Illinois stands at the head of the list with 42,000 square miles of coal-bearing formations, Missouri has 23,000, Kansas and Iowa 20,000, and Colorado nearly as much. The least is South Dakota, with 120 square miles; but Nebraska (Indian territory), Montana, and Wyoming have large areas, which are only in part touched. Illinois stands second to Pennsylvania in the coal-production of the United States. Coal in this state is being mined in 53 counties out of 102, and the 915 mines working last year turned out about 27,000,000 tons. In Wyoming the fields are in close proximity to known beds of copper and iron, so that it is merely a question of time when the

combined mining industries will be at work. The seams are very thick and numerous, and about 4½ million tons were produced last year. In Dakota the deposits are chiefly lignite, and very little development has as yet taken place. Missouri produces about 4 million tons, Kansas about the same, and Iowa rather more. The thin seams of coal in the south-west of Nebraska are the ends of those of the western coal-fields in the three last-mentioned states, and but little mining is undertaken.

AUSTRALASIA.

Meteorology in Australasia.—The excellent work which has been done by the Queensland Weather Bureau, since its organization under Mr. Clement L. Wragge in 1887, has been widely recognized, and much disappointment was naturally felt on the announcement, made in May last, that the Queensland Government felt itself compelled, by the necessity for retrenchment, to close the Bureau from June 30. Negotiations had been set on foot to secure the taking over of the work by the Federal Government, it being felt that the work was national in character, and as such could fairly claim to be performed under the auspices of the central authority. It was, however, found impossible to carry through the legislation necessary for the establishment of a Federal Meteorological Department during the current session of parliament, and considerable anxiety was felt lest the continuity of the valuable series of meteorological records from all parts of the country should be broken during the interregnum which seemed unavoidable, to say nothing of the risk incurred of loss or damage to the expensive self-recording instruments placed at the stations all over Queensland. This danger has, we are glad to say, not been realized, the Governments of Queensland, New South Wales, and Tasmania having provided funds, to the total extent of £1000 per annum, to enable Mr. Wragge to continue his useful work for the time being, at least, while the Federal Government has promised aid in the form of free transmission of meteorological data by the State telegraphs. The new office controlled by Mr. Wragge has been named the "Central Weather Bureau," and in connection with it he has commenced the publication of a journal (bearing the title *Wragge*) devoted to the interests of Australasian meteorology, and to serve as a medium for the issue of the weekly forecasts, which have in the past been a special feature of the Weather Bureau. The first number was issued on July 17.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Fauna of Mountain Lakes.—Prof. F. Zschokke (Basel), in his prize essay on the fauna of high mountain lakes, has compared it with that of lakes in the Riesengebirge and other mountains of moderate altitude, with results of considerable general importance. For this comparison he makes special use of the researches of Prof. O. Zacharias in the 'Koppenteichen' (see *Geographical Journal*, September, 1897, p. 323). Zschokke found that in a mountain system of relatively small elevation the alpine conditions and forms of life occur at a lower absolute level than in high mountains. The Grosse Teich, in the Riesengebirge, 4000 feet above sea-level, is inhabited by forty species; the Kleine Teich, 3830 feet, by fifty-two species. Of these species, Zschokke found from twenty to forty-eight per cent. in the lakes of the Rhætic Alps, near the Swiss-Austrian frontier, south-east of the Boden See, at altitudes of 6000 and 7200 feet. Further, he found that the fauna of alpine lakes at the same altitudes as those in the lower mountain systems differs little from that of lakes of the plains. The greater the mean and maximum elevation of the mountains, the higher the lakes of corresponding fauna. This fact

accords well with the observations of E. Richter on the snow-line, which in the central Alps occurs 2000 feet higher than in the northern and southern limestone Alps (see *Geographical Journal*, September, 1899, p. 316); and also with researches, notably those of Brückner, on the variations in the limiting levels of other elements. The relations now ascertained place the whole subject of *orometric values*, which has hitherto received but little attention in England, in a clear light. Corresponding to the similarity of fauna in the lakes, there is a similarity of conditions of light and temperature. The mean summer temperature of the water in the two groups does not exceed 50° to 54° Fahr. The topographic features in the immediate neighbourhood of the lakes must be taken into account. Faunistically similar lakes may lie in deeply shaded spots, but, on the other hand, those alpine lakes which are at the same elevations as the lakes of lower mountains may enjoy the same conditions as regards sunlight as low-lying lakes altogether outside the alpine region.

The Cruise of the "Princess Alice."—A letter from Mr. J. Y. Buchanan, containing an account of the work of the Prince of Monaco's yacht *Princess Alice* during this summer, was published in the *Times* of September 25. The yacht left Gibraltar on July 23, and steered westward towards the Azores. On the following day, being in a position where a remarkable haul of large crustaceans was made on the homeward journey last year, the trawl was put over in 800 fathoms. The trawl "failed to bring up the rich harvest of animals expected," although "it worked quite well, and brought up what it found, which was mainly mud." The bottom temperature was found to be 9° C., compared to a normal of 4°·5 C. at 800 fathoms in the North Atlantic, indicating that the position (lat. 36° 6′ N., long. 7° 56′ W.) was one of the main drains of overflow from the abysmal regions of the Mediterranean. A rough estimate shows that the bottom water was of Mediterranean and Atlantic origin in a mixture of about equal parts. The Gorringe or Getysburg bank, examined by the former *Princess Alice* on July 25, 1894, was re-examined on July 25, 1902. No new results of special importance were obtained, but Mr. Buchanan notes as remarkable that "the presence of the bank was shown quite unmistakably by the swirls and ripples on the surface of the sea to an extent that I have never witnessed on any other oceanic shoal having the same depth of water over it." July 27 was spent in sounding over the Josephine bank, depths of about 120 fathoms being uniformly obtained, and Punta Delgada was reached on July 31. On leaving Punta Delgada, the yacht proceeded to the channel which separates the islands of Terceira and St. Michael's, where a sounding of 1900 fathoms was obtained by the *Hirondelle* some years ago. A depth of 1645 fathoms was obtained near the old spot, confirming the existence of deep water in this locality. The bottom temperature was 5° C., two degrees above the normal for the depth, indicating that this depth occurs in an enclosed basin. The existence of this basin was confirmed by other soundings, and it was appropriately named the "Hirondelle deep." The rim of the basin is 850 to 900 fathoms from the surface. A few days were next spent on the Princess Alice bank, south-west of Fayal, and it is remarkable that, whereas this has hitherto proved a very productive fishing-ground, this year "hardly anything of any kind was caught by any means." On quitting the islands, the yacht made for a spot where two soundings of 70 and 48 fathoms, attributed to the ship *Chaucer*, 1850, are marked. The soundings were not confirmed, but some evidence was obtained that a bank may exist in the vicinity, although time did not allow of full investigation. During the search, on September 6, the trawl dragged into shallow water at a point where a depth of 1300 fathoms was expected, and brought up a remarkable haul of manganese-covered coral. The yacht returned to Havre on September 17.

Earthquakes and Volcanic Phenomena.—The following are the chief disturbances recorded since our last number went to press. It was reported by the correspondent of the *Pioneer* that a severe earthquake occurred at Kashgar on August 22, doing great damage, and killing about 700 people. The air-temperature began to rise after the earthquake, and continued high for a week, slight shocks recurring during that time. Earthquake shocks occurred over a considerable part of South Australia on September 19. On September 23 serious earthquakes were experienced in Guatemala and British Honduras; and next day Mount Chullupata, near Calendin, Ecuador, a mountain never known to have been active, was reported as having ejected dust and smoke for a fortnight. Numerous earthquake shocks occurred on the island of Guam on September 25. On September 26 Mount Etna sent up a thick column of steam from a point near that of the eruption of 1892. The St. Vincent Soufrière suffered slight eruption on October 1. It had been quiescent for a week, and the eruption subsided next day. After a blank of nearly a fortnight come reports from Oban and Fort William that shocks of earthquake were experienced in the western Highlands of Scotland on the evening of October 13. The shocks were severely felt at Ardnamurchan, cracking the walls of a mansion belonging to Mr. Rudd. On the following evening, and the morning of the 15th, shocks were again felt in several districts of Argyllshire. A telegram from Barbados, dated October 16, reported that volcanic dust from St. Vincent was falling in quantities sufficient to cause a stoppage of business; and next day the *New York Herald* stated that a serious eruption of La Soufrière occurred on the night of the 15th. The eruption reached its greatest violence between 1 a.m. and 5 a.m. on the 16th. Volcanic sand fell in large quantities over the whole island, and severe earthquake shocks were felt at Chateau Belair. Georgetown was believed to be in great danger, and was being evacuated.

GENERAL.

Livingstone's Old Compass.—This Society has recently added to its already interesting collection of relics of early explorers, the boat's compass which was used by Dr. Livingstone on his first journey down the Zambezi valley in 1856, and which, with other articles, was left at Tete in charge of Major Sicard, who was then the Portuguese commandant at that place. On the return of the famous missionary-explorer to Tete during his second expedition, the compass was not claimed, probably because he had been provided with better instruments, and it remained at Tete in the old residency until 1899, when it was given by the then Governor-General of Mozambique, Senhor Angusto de Castilho, to Mr. Carlos Wiese for use whilst acting in charge of the Portuguese Mpeseni expedition. At the close of this expedition, and before Mr. Wiese returned to Europe, it was handed by him to his friend and companion, Angusto da Fonseca Mesquita e Sola, the acting Governor of Tete, for use during his various journeys and surveys, by whom the lid of the old compass box was replaced by another, as the original, which bore various inscriptions relating to the history of the compass and scientific memoranda by Dr. Livingstone, had been destroyed by white ants. On the death of Senhor Sola in December, 1901, the compass was claimed from amongst his effects by Mr. Wiese, and, after due formalities and proof, was handed over by the Portuguese Government to Vice-Consul H. R. Wallis, at Tete, by request of Mr. Wiese, and presented to him by latter gentleman. Mr. Wallis in due course forwarded it to the Foreign Office, with the request that it might be presented to this Society. The compass is of French manufacture, made by Dubas, Nantes, with a card of 7 inches diameter. It had been fitted with special sights for taking observations, and somewhat roughly mounted, possibly by Dr. Livingstone himself. A document

giving an outline of its history accompanies this interesting relic, signed by the Portuguese Commandante Militar Superior at Tete, Mr. Carlos Wiese, and Vice-Consul H. R. Wallis.

Geography at London and Birmingham Universities.—The regulations lately issued with regard to geography, both at London and Birmingham universities, show that satisfactory progress is being at last made towards a just appreciation of the possibilities offered by the subject as a branch of scientific study. Especially gratifying is the fact that the old arbitrary division between physical and political geography seems at last to be disappearing, with a corresponding gain to the unity of the subject and its special value as the meeting-ground of the sciences of Nature and Man. The revised regulations for the matriculation examination at London university put down "Physical and General Geography" as one of the twenty-two subjects from which two out of the total of five subjects offered may be selected. It is, therefore, not obligatory, but is placed on the same footing with history (ancient or modern), logic, biology, etc. The importance of regional treatment is fully recognized in the syllabus, and especial attention is directed to such aspects of the regions studied as the contrasts and features of land-relief, climatic contrasts and their effect on agriculture, the position and characteristics of regions of dense or sparse population, and so forth; while a knowledge must be shown of the main physical causes of the phenomena described. The Birmingham University Calendar for 1902–1903 (Macmillan) contains a full statement of the various subjects included under the faculties of science, art, commerce, and medicine, and it is satisfactory to find that geography has been conceded a place under the first head. Physical and political geography are here too united as a single subject, the two branches being taken concurrently during two years. Thus, besides a study of the present surface features and the agents of change to which they are due, attention is directed to Man and his works, as related to the phenomena of the Earth on which he dwells. The regional aspect of the subject is throughout kept well in view.* It is, however, somewhat disappointing to find that the subject ranks only (like physiography) as a branch of Geology, and no clue is given to the weight attached to it in the final examination. The division between physiography and physical geography is likewise a little unfortunate, the former being treated as a distinct subject, although it deals not only with the principles underlying all geographical science, but such special branches of the subject as the origin and development of landscape features, drainage systems, etc.; in fact, the whole of the science of geomorphology as well as of the distribution of life upon the surface. A certain amount of overlapping of the subjects, therefore, seems inevitable. Again, from its place in the faculty of science, geography cannot be taken up as a subject in itself by students under the faculty of commerce, although its vital importance in relation to many of the subjects included in the latter cannot be gainsaid. Such difficulties must arise until the importance of geography as a meeting-ground of many different studies is still further recognized by its adoption as one of the fundamental bases of university education.

Long Vacation Course at Cambridge.—The reader in geography at Cambridge, Mr. H. Yule Oldham, during August delivered a course of twelve lectures on "Geography in its Physical Aspects," which were attended by 172 students, nearly all teachers in schools, for whom the lectures were principally intended. Among them were students from France, Germany, Holland, Norway, South

* The syllabus is hardly up-to-date in its recommendations as to text-books of Political Geography, no mention being made, *e.g.*, of Mill's 'International Geography.'

Africa, and the United States. A good deal of practical work was also done in the open, and a special excursion made to the Fen country, when some important experiments on the curvature of the Earth's surface were performed.

The Wheat Crop of 1902.—*Export* (xxiv. No. 40) quotes from the *Bulletin des Halles, Bourses et Marchés* statistics of the wheat crop of the world for 1902, by countries, with a comparison of the same crop in 1900 and 1901. The total production of European and extra-European countries together is given at 1,037,185,000 hectolitres (356,662,000 quarters), of which Europe produced about 56·4 per cent. Although considerably larger than the total of the three preceding years, this amount fell short of that recorded for 1898, which was the largest yet attained. Most of the European countries show an increase as compared with either of the two preceding years, the two largest producers—Russia and France—showing increases on 1901 of 9·3 and 10·5 per cent. respectively. The total yield of extra-European countries is put below the figure for 1901, the deficit being due almost entirely to a decreased yield in the United States and India, which show a fall of 12·7 and 11 per cent. respectively. Thus whereas the yield of the United States in 1901 exceeded that of Russia and France combined, in 1902 the position was reversed. Canada (the yield from which is shown as identical in 1901 and 1902, that for the latter being possibly estimated only) comes ninth on the list, being surpassed by six European countries (Russia, France, Austria-Hungary, Germany, Italy, Spain), as well as by the United States and India.

OBITUARY.

Canon Rawlinson.

Among geographers the name of Rawlinson will always recall the memory of that distinguished authority on all questions relating to Central Asia, whether geographical, historical, or political, who received the Founder's Medal of our Society more than sixty years ago, and who was twice President of the Royal Geographical Society. Sir Henry Rawlinson's younger brother, George, whose death occurred early last week, was the classical scholar and historian rather than the geographer. Indeed, though within a few weeks of his ninetieth birthday at the time of his death, his election as a Fellow of the Society dates no further back than 1890. Canon Rawlinson possessed, however, an extensive and intimate knowledge of the lands and old-world peoples of the nearer East. Born November 23, 1812, he obtained a First Class in the Final School of Classics at Oxford in 1838, and two years later was elected to a Fellowship at Exeter College. After a brief absence from Oxford subsequent to his marriage in 1846, he resumed work at the University, and, pursuing his own studies in addition to his other labours, brought out in 1858 his well-known translation of Herodotus, enriched with many valuable notes, not only from his own pen, but by Sir Henry Rawlinson and Sir Gardner Wilkinson. In 1861 he was appointed to the Camden Chair of Ancient History, which he occupied until 1889. The first fifteen years of his professorship saw the production of Canon Rawlinson's great work on the early monarchies of the Eastern World. His theory of a Chaldean monarchy provoked some criticism, but in subsequent editions of the work it has not been found necessary materially to modify the view originally expressed. Among other books that have issued from Canon Rawlinson's

pen, we may mention a 'Manual of Ancient History,' which appeared in 1869; a 'History of Egypt' (1881); a 'History of Phœnicia' (1889), written for the Story of the Nations Series; and a 'History of Parthia' (1893).

Mr. R. A. Sterndale.

We regret to announce the death, which occurred on October 3, of Mr. Robert Armitage Sterndale, C.M.G., Governor of St. Helena, and a Fellow of the Society for the past quarter of a century. Mr. Sterndale was born in Derbyshire in 1839, and at the age of seventeen left this country to take up an appointment under the Indian Government, in whose service he remained until 1890. During the Indian Mutiny he served in the army as a volunteer officer, but on the conclusion of military operations returned to civilian employment. In the Financial Department he gradually worked his way up from one post to another until he became Accountant-General, first for Bombay, and afterwards for Madras. He took a great interest in geographical and other scientific studies, and published an account of the district of Seoni, and works on, amongst other subjects, the mammalia of British India and Ceylon, denizens of the jungle, and Turkey and India. After his retirement from the service of the Indian Government, Mr. Sterndale conducted the administration of St. Helena in 1895–96, and a year later was appointed governor of the island.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria. *Petermanns M.* **48** (1902): 121–132. **Graber.**

Geomorphologische Studien aus dem oberösterreichischen Mühlviertel. Von Dr. Hermann Veit Graber. *With Map.*

Balkan Peninsula. **Beck von Mannagetta.**

Die Vegetation der Erde. . . . herausgegeben von A. Engler und O. Drude. IV. Die Vegetations-Verhältnisse der illyrischen Länder begreifend Südkroatien, die Quarnero-Inseln, Dalmatien, Bosnien und die Hercegovina, Montenegro, Nordalbanien, den Sandžak Novipazar und Serbien. Von Dr. Günther Ritter Beck von Mannagetta. Leipzig: W. Engelmann, 1901. Size 10½ × 7, pp. xvi. and 534. *Maps and Illustrations.*

This will be the subject of a notice.

Bulgaria—Rainfall. *Petermanns M.* **48** (1902): 145–151. **Kassner.**

Die Niederschlagsverteilung in Bulgarien. Von Dr. C. Kassner. *With Map.*

France. **Baedeker.**

Southern France, including Corsica. Handbook for Travellers by Karl Baedeker. Leipsic: Karl Baedeker; London: Dulau & Co., 1902. Size 6½ × 4½, pp. xxviii. and 548. *Maps, Plans, and Panorama. Price 9m. 2 copies, one presented by the Editor, the other by Messrs. Dulau & Co.*

France—Brittany. **Baring-Gould.**

Brittany by S. Baring-Gould. London: Methuen & Co., 1902. Size 6 × 4, pp. ix. and 248. *Maps and Illustrations. Price 3s. Presented by the Publishers.*

This little guide will be found of much use to the visitor to Brittany, giving as it does a bird's eye view of all that most deserves attention on the part of the tourist. The first part deals in turn with the general features, geology, botany, history, antiquities, etc., of the country, and is followed, as is the case in other guides of the series, with a description of the places arranged alphabetically. The illustrations are exceedingly tasteful.

France—Seine-et-Marne. *Ann. G.* **11** (1902): 295–314. **Barré.**

Le Relief de la forêt de Fontainebleau. Par O. Barré. *With Map and Sections.*

France—Statistics. ——

République Française. Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes. Direction du Travail. Statistique Générale de la France. Annuaire Statistique. Vingt-et-unième volume. 1901. Paris, 1902. Size 11 × 7½, pp. xlii. and 592.

France—Towns. *G. Teacher* **1** (1902): 97–108. **Dickinson.**

The Position of Towns. Illustrated by an analysis of the Natural Regions and Centres of France. By B. B. Dickinson. *With Maps.*

Germany—Botanical Geography. **Graebner.**

Die Vegetation der Erde. . . . herausgegeben von A. Engler und O. Drude. V. Die Heide Norddeutschlands und die sich anschliessenden Formationen in biologischer Betrachtung. Eine Schilderung ihrer Vegetationsverhältnisse, ihrer Existenzbedingungen und ihrer Beziehungen zu den übrigen Pflanzenformationen, besonders zu Wald und Moor, bearbeitet von P. Graebner. Leipzig: W. Englemann, 1901. Size 10½ × 7, pp. xii. and 320. *Maps and Illustrations.*

This will be specially noticed.

Germany—Earthquake Stations. *Petermanns M.* **48** (1902): 151–160. **Gerland.**

Ueber Verteilung, Einrichtung und Verbindung der Erdbebenstationen in Deutschen Reich. Von Prof. Dr. G. Gerland. *With Map.*

Germany—Hanover. **Nedderich.**

Wirtschaftsgeographische Verhältnisse, Ansiedlungen und Bevölkerungsverteilung im Ostfälischen Hügel- und Tieflande. Von Dr. Wilhelm Nedderich. (Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Vierzehnter Band, Heft 3.) Stuttgart: J. Engelhorn, 1902. Size 9½ × 6½, pp. 151–330. *Maps. Price 9m.*

The district dealt with lies around Hildesheim.

Germany—Mammalia. *Z. Ges. Erdk. Berlin* (1902): 473–497. **Matschie.**

Die Säugetierwelt Deutschlands, einst und jetzt, in ihren Beziehungen zur Tierverbreitung. Von Paul Matschie.

Germany—Plant-distribution. **Schulz.**

Studien über die phanerogame Flora und Pflanzendecke des Saalebezirkes. Von Dr. August Schulz. 1. Die Wanderungen der Phanerogamen im Saalebezirke seit dem Ausgange der letzten kalten Periode. Halle-a.-S., Tausch & Grosse, 1902. Size 9½ × 6½, pp. 58. *Map.*

Hungary—Gravity-determinations. **Sterneck.**
M.K. u. K. Militär.-G. I. **21** (1901): 77–98.

Relative Schwerebestimmungen in der Umgebung des Plattensees, ausgeführt im Jahr 1901. Von Dr. Robert v. Sterneck.

Italy. *B.S.G. Italiana* **3** (1902): 675–682. **Bertolini.**

Per la storia della conoscenza scientifica del nostro paese. Il fenomeno dei colori complementari al Monte San Genesio. Nota del prof. Gian Lodovico Bertolini.

The author quotes the description given early in the nineteenth century by Guiseppe Cortesi, of the phenomenon observed on Monte San Genesio, which consists in the assumption of a greenish colour by objects seen in association with the bright red soil of the mountain.

Italy—Arno. *Riv. G. Italiana* **9** (1902): 368–374, 425–436. **Oberti.**

Il bacino dell' Arno. Saggio di geografia fisica e antropica del Prof. Eugenio Oberti.

Italy—Earth-movements. *B.S.G. Italiana* **3** (1902): 579–597. **Stefano.**

Probabile sollevamento attuale della costa Jonica calabrese? Osservazioni di fisiodinamica e brevi cenni sul bradisisma della Calabria occidentale. Nota del dott. Giuseppe de Stefano.

Italy—Rome. *Atti R.A. Lincei, Rendiconti* **11** (1902): 431–433. **Reina.**

Determinazioni astronomiche di latitudine e di azimut esequite a Roma (S. Pietro in Vincoli), a M. Cimino ed a M. Peglia negli anni 1900 e 1901. Nota del prof. V. Reina.

Italy—Sardinia. *Sitzb. K.P.A.W. Berlin* (1902): 808–829. **Tornquist.**

Ergebnisse einer Bereisung der Insel Sardinien. Von Prof. Dr. A. Tornquist.

This is the subject of a note (p. 534, *ante*).

Italy—Sicily. **Churchill.**

Trade of Sicily for the year 1901. Foreign Office, Annual No. 2887, 1902. Size 9½ × 6, pp. 58. *Price* 3*d.*

During 1901, a new British line started a regular service from London to Palermo.

Northern Europe—Lakes. **Pettersson.**

Resultaten af den internationella Undersökningen af norra Europas djupa sjöar och innanhaf år 1900. Sammanställda af O. Pettersson. (Bihang till K. Svenska Vet.-Akad. Handlingar. Band 28. Afd. II. No. 2.) Stockholm: P. A. Norstedt & Söner, 1902. Size 8½ × 6½, pp. 18.

Records determinations of serial temperatures for various lakes of Sweden, Finland, etc., at different times of year.

Norway—Auroras. **Tromholt.**

Catalog der in Norwegen bis juni 1878 beobachteten Nordlichter, zusammengestellt von Sophus Tromholt. Herausgegeben von J. Fr. Schroeter. Kristiania, 1902. Size 12½ × 9½, pp. xxiv. and 422.

Russia. **Baedeker.**

La Russie. Manuel du Voyageur par K. Baedeker. Troisième Édition refondue et mise à jour. Leipzig: Karl Baedeker, 1902. Size 6½ × 4½, pp. l. and 476. *Maps and Plans. Price* 15*m. Presented by the Author.*

This corresponds to the fifth German edition, issued in 1901, and, like it, has been much extended as compared with the previous edition, especially as regards the Caucasus and the Russian Asiatic railways.

Russia—Poland and Lithuania. **Murray.**

Trade and Agriculture of Poland and Lithuania for the year 1901. Foreign Office, Annual No. 2810, 1902. Size 9½ × 6, pp. 42. *Price* 2½*d.*

Russia—Ural. **Duparc and Pearce.**
Mém. S. Phys. et d'Hist. Nat. Genève **34** (1902): 57–218.

Recherches géologiques et pétrographiques sur l'Oural du Nord dans la Rastesskaya et Kizelowskaya-Datcha (Gouvernement de Perm). Par Louis Duparc et Francis Pearce. *With Map and Plates.*

This will be noticed in the Monthly Record.

Spain—Mining Industry. ——

Mining Industry in Spain during the year 1901. Foreign Office, Miscellaneous, No. 579, 1902. Size 10 × 6, pp. 28. *Price* 2*d*

Sweden—Gothland. ———

The Ancient City of Wisby, once the Queen of the Baltic. Island of Gothland, Sweden. Stockholm, 1902. Size 8 × 4½, pp. 28. *Map (on cover) and Illustrations.*

Switzerland—Census. ———

La Population des Communes de la Suisse. Par le Bureau de statistique du Département fédéral de l'Intérieur. Bern: Stämpfli & Cie., 1901. Size 11½ × 9, pp. 32.

Switzerland—Simplon Tunnel. ———

Rapport sur les venues d'eau rencontrées dans le tunnel du Simplon du côté d'Iselle. Lausanne: Imp. Corbaz and Cie., 1902. Size 11 × 8½, pp. 28. *Profile. Presented by Mr. Heinrich Brunner.*

Turkey—Monastir. **Castelmola.**

Turchia. Il Vilaiet di Monastir. Rapporto del Cav. O. Gastani d'Aragona di Castelmola. Bollettino del Ministero degli Affari Esteri. Maggio 1902. Roma, 1902. Size 9 × 6, pp. 16.

United Kingdom—Bognor. **Morris and Thompson.**

Bognor Climatological Society. Annual Report and Results of the Observations made during the year 1901, at the Bognor Climatological Station. By H. C. L. Morris and A. G. Thompson. Size 9½ × 7, pp. 6. *Tables.*

United Kingdom—Dartmoor. *Geolog. Mag.* **9** (1902): 397–401. **Lowe.**

A Fragment of Physical Geography: The Past and Present of a bit of Dartmoor. By Harford J. Lowe. *With Sketch-maps.*

United Kingdom—England. *Quarterly J. Geolog. S.* (1902): 572–608. **Dwerryhouse.**

The Glaciation of Teesdale, Weardale, and the Tyne Valley, and their Tributary Valleys. By A. R. Dwerryhouse. *With Maps and Sections.*

United Kingdom—England—Devon. **Ussher.**

Memoirs of the Geological Survey, England and Wales. The Geology of the Country around Exeter. (Explanation of Sheet 325.) By W. A. E. Ussher. With Notes on the Petrology of the Igneous Rocks. By J. J. H. Teall. London: E. Stanford, 1902. Size 9½ × 6, pp. vi. and 122. *Sections. Price* 2*s.*

United Kingdom—England—Devon. **Ward and Baddeley.**

Thorough Guide Series. South Devon (including West Dorset Coast from Weymouth) and South Cornwall, with a full description of Dartmoor and the Scilly Isles. By C. S. Ward and M. J. B. Baddeley. 6th Edition, Revised. London: Dulau & Co., 1902. Size 6½ × 4½, pp. 8, xx., and 230. *Maps and Plans. Price* 4*s. net. Presented by the Publishers.*

The section-maps are contoured in this edition.

United Kingdom—England—Essex. *Nineteenth Century* **52** (1902): 239–250. **Hunter.**

The Reconstruction of Hainault Forest. By Sir Robert Hunter. *With Map.*

United Kingdom—England—Hampshire. **Reid.**

Memoirs of the Geological Survey. England and Wales. The Geology of the Country around Ringwood. (Explanation of Sheet 314.) By Clement Reid, F.R.S. With Contributions by F. J. Bennett and Ernest E. L. Dixon. London: E. Stanford, 1902. Size 9½ × 6, pp. 62. *Sketch-map. Price* 1*s.*

United Kingdom—England—Hampshire. **Reid.**

Memoirs of the Geological Survey. England and Wales. The Geology of the Country around Southampton. (Explanation of Sheet 315.) By Clement Reid, F.R.S. With Contributions by W. Whitaker. London: E. Stanford, 1902. Size 9½ × 6, pp. iv. and 70. *Illustrations. Price* 1*s.* 6*d.*

United Kingdom—England—Norfolk. **Dutt.**

Norfolk. By William A. Dutt. London: Methuen & Co., 1902. Size 6 × 4, pp. vii. and 277. *Maps and Illustrations. Price* 3*s. Presented by the Publishers.*

Like others of this dainty series of 'Little Guides,' this consists of general chapters on Norfolk from various points of view, occupying some forty pages, followed by detailed descriptions of all the more important places, which make up the bulk of the volume. It thus forms a handy compendium of all that is of most interest in the county.

United Kingdom—Gales. *Q.J.R.S. Meteorolog.* **28** (1902): 121–158. **Brodie.**

The Prevalence of Gales on the Coasts of the British Islands during the Thirty years 1871–1900. By Frederick J. Brodie. *With Diagrams.*

United Kingdom—Ireland. **Baddeley.**

Thorough Guide Series. Ireland (Part i.): Northern Counties, including Dublin and Neighbourhood. By M. J. B. Baddeley. Fifth Edition, Revised. London: Dulau & Co., 1902. Size 6½ × 4½, pp. xvi., 12, and 212. *Maps and Plans. Price 4s. net. Presented by the Publisher.*

All the section maps are contoured in this edition, and additions and corrections have been made in the text in points of detail.

United Kingdom—Ireland. **Hoskyn.**

The Irish Coast Pilot. Originally compiled from various Admiralty Surveys. By Staff Commander Richard Hoskyn. Fifth Edition. London, 1902. Size 9½ × 6, pp. xx. and 564. *Chart. Price 3s. 6d. Presented by the Hydrographer, Admiralty.*

United Kingdom—Lake District. **Baddeley.**

Thorough Guide Series. The English Lake District. By M. J. B. Baddeley. Ninth Edition, thoroughly Revised. London: Dulau & Co., 1902. Size 6½ × 4½, pp. xxx., 248, and 20. *Maps, Plan, and Panoramas. Price 5s. net. Presented by the Publishers.*

The rapidity with which new editions of this guide have been called for, is an evidence of its excellence, as well as of the popularity of the district with which it deals. A small addition which might prove useful in the next edition would be the extension of map No. 9 in the south-east corner, so as to bring both upper branches of Great Langdale into one sheet. The tracks over the Garburn pass, and over Matterdale common at the northern end of the Helvellyn range, might also be shown as possible for cyclists, as their use occasionally saves a long *détour*, and neither is so rough as that over the Wrynose pass.

United Kingdom—London. *Nineteenth Century* **52** (1902): 94–111. **Egerton.**

The Port of London. By the Right Hon. Earl Egerton of Tatton. *With Map.*

United Kingdom—Scotland. *J.G.* **1** (1902): 160–167. **Luther.**

The Weavers of the Western Isles. By Agnes Vinton Luther. *With Illustrations.*

United Kingdom—Scotland—Edinburgh. **Richardson.**

Scottish G. Mag. **18** (1902): 337–357.

The Physiography of Edinburgh. A View from Arthur's Seat. By Ralph Richardson. *With Map. Also separate copy, presented by the Author.*

ASIA.

Asia. *Deutsche Rundschau G.* **24** (1902): 499–510. **Jüttner.**

Fortschritte der geographischen Forschungen und Reisen im Jahre 1901. 2. Asien. Von Dr. J. M. Jüttner.

Central Asia. *G.Z.* **8** (1902): 249–266, 323–339. **Futterer.**

Der Pe-schan als Typus der Felsenwüste. Ein Beitrag zur Charakteristik der Felsenwüsten Zentralasiens. Nach eigenen Erfahrungen und Forschungen zusammengestellt von Prof. Dr. K. Futterer. *With Plates.*

Central Asia. *Petermanns M.* **48** (1902): 160–162. **Hedin.**

Uebersicht meiner Reisen in Zentralasien 1899–1902. Von Dr. Sven v. Hedin. *With Map.*

China. *Tour du Monde* **8** (1902): 313–372. **Leprince-Ringuet.**

Voyage dans les Provinces du Nord de la Chine (1898–1899). Par F. Leprince-Ringuet. *With Map and Illustrations.*

China—Trade. ———

China. Imperial Maritime Customs. 1. Statistical Series: Nos. 3 and 4. Returns of Trade and Trade Reports for the year 1901. Part i. Report on the Trade of China, and abstract of Statistics. Shanghai, 1902. Size 11 × 8½, pp. 34.

Chinese Empire—Tibet. **Chandra Das.**

Journey to Lhasa and Central Tibet. By Sarat Chandra Das. Edited by the Hon. W. W. Rockhill. London: John Murray, 1902. Size 8½ × 5½, pp. xiv. and 286. *Price 12s. net. Maps, Plans, and Illustrations.*

This is the latest issue of the extra publications of the Royal Geographical Society. It will be noticed elsewhere.

Chinese Empire—Tibet. **Magnaghi.**

Riv. G. Italiana **8** (1901): 545, 609; **9** (1902): 39, 105, 170, 241, 299.

Relazione inedita di un viaggio al Tibet, del Padre Cassiano Beligatti da Macerata (prima metà del secolo xviii.). Per Alberto Magnaghi.

Eastern Asia. *Sitzb. K.P.A.W. Berlin* (1902): 944–975. **Richthofen.**

Geomorphologische Studien aus Ostasien, III. Die morphologische Stellung von Formosa und den Riukiu-Inseln. Von Ferdinand von Richthofen. *With Map.*

This will be noticed elsewhere.

French India. **Castonnet des Fosses.**

L'Inde Française au XVIII^e^ siècle. Ouvrage posthume de Henri Castonnet des Fosses. Paris: Société de Géographie Commerciale [not dated]. Size 7½ × 5, pp. vi. and 458. *Portrait. Price* 3.50 *fr.*

A clear and instructive account of the early French commercial intercourse with India, and the struggle with Great Britain down to the death of Dupleix.

India—Census.

Census of India, 1901. Vol. iv. Assam. Part i. Report. By B. C. Allen (Shillong, 1902, pp. xvi. and 180). Vol. iv*a*. Assam. Part ii. Tables. By B. C. Allen (Shillong, 1902, pp. 306). Vol. viii. Berar. Part i. Report. By Ardaseer Dinshawji Chinoy (Allahabad, 1902, pp. xii. and 278). Vol. viii*a*. Berar. Part ii. Imperial Tables. By A. D. Chinoy (Allahabad, 1902, pp. 208). Vol. viii*b*. Berar. Part iii. Provincial Tables. By A. D. Chinoy (Allahabad, 1902, pp. 124). Vol. ix. Bombay. Part i. Report. By R. E. Enthoven (Bombay, 1902, pp. viii. and 260). Vol. ix*a*. Bombay. Part ii. Imperial Tables. By R. E. Enthoven (Bombay, 1902, pp. ii., 560, and cxii.). Vol. ix*b*. Bombay. Part iii. Provincial Tables. By R. E. Enthoven (Bombay, 1902, pp. 282). Vol. x. Bombay (Town and Island). Part iv. History. By S. M. Edwardes (Bombay, 1901, pp. ii. and 156). Vol. xi. Ditto. Part v. Report. By S. M. Edwardes (Bombay, 1901, pp. 116). Vol. xi*a*. Ditto. Part vi. Tables. By S. M. Edwardes (Bombay, 1901, pp. 330). Vol. xiii. Central Provinces. Part i. Report. By R. V. Russell (Nagpur, 1902, pp. xii. and 314). Vol. xiii*a*. Central Provinces. Part ii. Imperial Tables. By R. V. Russell (Allahabad, 1902, pp. 600). Size 13½ × 8½. *Maps, Plans, etc.*

India and Ceylon. **Brown.**

From Calcutta to Bombay Coasting, being the second edition of the Handbook to the Ports on the Coast of India between Calcutta and Bombay, including Ceylon, and the Maldive and Laccadive Islands. By Lieut. H. S. Brown. London: J. D. Potter. 1902. Size 9½ × 6, pp. 358. *Charts and Illustrations. Price* 10*s. Presented by the Publisher.*

India—Nicobar Islands. *J. Anthrop. I.* **32** (1902): 202–238. **Solomon.**

Extracts from Diaries kept in Car Nicobar. By V. Solomon. 1895–1901. *With Plate.*

The author, whose diaries deal chiefly with native customs and ceremonies, is a native government agent, formerly a catechist, who has done much in the interests of civilization in the group.

India and Persia. **Ronaldshay.**

Sport and Politics under an Eastern Sky. By the Earl of Ronaldshay. Edinburgh and London: W. Blackwood & Sons. 1902. Size 9½ × 6½, pp. xxiv. and 414. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

This will be reviewed elsewhere.

India—Rajputana. *P.I. Civil Engineers* **148** (1902): 263–275. **Hearn.**

Railway Surveying on the Pipli Ghat. By Captain G. R. Hearn. *Plans.*

Describes a survey for a line from Bara to Marwar, across the Aravalli range, designed to supply a link on a new route between Calcutta and Karachi.

India—Trigonometrical Survey. **Eccles.**

Account of the Operations of the Great Trigonometrical Survey of India. Vol. iv. Details of the Tidal Observations taken during the period from 1873 to 1892, and a description of the Methods of Reduction. By J. Eccles. Prepared under the Directions of Major S. G. Burrard. Published under the orders of Col. St. G. C. Gore. Dehra Dun, 1901. Size 12½ × 10, pp. xvi., 384, and 152. *Charts, Diagrams, and Plates. Price* 10 *rupees* 8 *annas. Presented by the Survey of India.*

Korea. **Goffe.**

Trade of Corea for the year 1901. Foreign Office, Annual No. 2849, July, 1902. Size 9½ × 6, pp. 26. *Diagram.*

Includes some details on the railways, existing and projected, of Korea.

Malay Archipelago—Java. **Davids.**

Trade of Java for the year 1901. Foreign Office, Annual No. 2863, July, 1902. Size 9½ × 6, pp. 22.

Malay Peninsula. *J. Anthrop. I.* **32** (1902): 124–141. **Skeat.**

The Wild Tribes of the Malay Peninsula. By W. W. Skeat. *With Illustrations.*

Malay States. **Treacher.**

Report by the Resident-General of the Federated Malay States to H.E. the High Commissioner. Kuala Lumpur, 1902. Size 13½ × 8½, pp. 26. *Diagrams.*

Persia. **Durand.**

An Autumn Tour in Western Persia. By E. R. Durand. London: A. Constable & Co., 1902. Size 9 × 5½, pp. 266. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

A brightly written account of a circular journey through the mountainous districts of south-west Persia, carried out by Sir Mortimer and Lady Durand in 1899. The principal objects were to see the old capital of Ispahan; to make the acquaintance of the Bakhtiari chiefs and inspect the new trade route then being opened up through their country; to visit the Karun and examine the conditions of trade on it; and, lastly, to return through Luristan and study the possibility of the opening of a trade route through it to the north. Although the author does not claim to present any decidedly new information on the country, and eschews political questions, the book contains many interesting details on the land and its inhabitants, and throws a useful light on the present state of affairs in a region now attracting general attention.

Persia. *Petermanns M.* **48** (1902): 142. **Stahl.**

Die durch Nivellierung des Rescht-Teheraner Wegs erhaltenen Höhen. Von A. F. Stahl.

A table is given showing the figures obtained by previous observers, side by side with those determined (for 25 places) by levelling in 1900.

Persia. **Stuart.**

The Struggle for Persia. By Donald Stuart. London: Methuen & Co., 1902. Size 8 × 5, pp. x. and 268. *Portrait. Price 6s. Presented by the Publishers.*

Written by an avowed Russophobe, this work is largely political in character, but the account of the autumn journey from Russia to Teheran by the difficult mountain route *viâ* Tabriz is of some geographical interest, while a chapter is devoted to prospective railway development.

Turkey. *Asien* **1** (1902): 53–57, 95–98. **Warburg.**

Jüdische Ackerbaukolonieen in Anatolien. Von Prof. Dr. O. Warburg. *With Illustrations.*

Turkey—Aleppo and Adana. **Barnham and Massy.**

Trade of Vilayets of Aleppo and Adana for the year 1901. Foreign Office, Annual No. 2785, 1902. Size 9½ × 6, pp. 26. *Price 2d.*

Turkey—Asia Minor. *Die Natur* **51** (1902): 121–123, 137–139. **Schleiff.**

Wald und Waldwirtschaft im nördlichen Anatolien. Von V. Schleiff.

Turkey—Damascus. **Richards.**

Trade of Damascus for the year 1901. Foreign Office, Annual No. 2832, June, 1902. Size 9½ × 6, pp. 30.

Turkey—Kurdistan. *P.R.I.* **16** (1902): 640–655. **Percy.**

Turkish Kurdistan. By the Right Hon. Earl Percy.

Turkey—Palestine. **Macalister.**

Palestine Exploration Fund Quarterly Statement (1902): 227–232.

The History and Site of Gezer. By R. A. Stewart Macalister.

Turkey—Syria. **Drummond-Hay.**

Trade of Beirut and Coast of Syria for the year 1901. Foreign Office, Annual No. 2836, July, 1902. Size 9½ × 6, pp. 24.

Western Asia. *Asien* **1** (1902): 91–94. **Schlagintweit.**

Die Eisenbahnen im westlichen Vorderasien. Von Major a. D. Max Schlagintweit. *With Map.*

AFRICA.

Abyssinia. *La G., B.S.G. Paris* **5** (1902): 401–430. **Bozas.**

Voyage au pays des Aroussi (Ethiopie méridionale). Par Vicomte du Bourg de Bozas. *With Map and Illustrations.*

See note in the August *Journal* (*ante*, p. 229).

Africa. *J. African S.* (1902): 444–451. **Stopford.**

A Neglected Source of Labour in Africa. By Colonel J. G. B. Stopford.

On the possible utilization of the African elephant.

British Central Africa. **Sharpe.**

Trade and General Condition of the British Central Africa Protectorate for the year 1901–1902. Foreign Office, Annual No. 2872, 1902. Size 9½ × 6, pp. 42. *Price* 2½*d.*

Cape Colony—Water-Supply. *P.I. Civil Engineers* **147** (1902): 308–323. **Ritso.**

Boring for Water in the Cape Colony. By B. W. Ritso.

Central Africa. *Rev. G.* **51** (1902): 97–108. **Dornin.**

La question musulmane dans le Centre Africain. Par Pierre Dornin. *With Map.*

Congo Basin. **Cornet.**

La géologie du bassin du Congo d'après nos connaissances actuelles (1897). Par J. Cornet. (Extrait du *Bulletin de la Société Belge de Géologie*, etc., Tome xii., 1898, pp. 31–53.) Brussels, 1901. Size 9½ × 6½.

Congo State. **Cornet.**

Notes sur des roches du Mont Bandupoi et du Haut Uellé. Par J. Cornet. (Extrait du *Bulletin de la Société Belge de Géologie*, etc., Tome xii., 1898, pp. 26–30.) Bruxelles, 1901. Size 9½ × 6½.

Congo State. **Whitehead.**

Trade of the Independent State of the Congo for the year 1901. (Summary.) Foreign Office, Annual No. 2818, 1902. Size 9½ × 6, pp. 10. *Price* 1*d.*

The exports from the Congo continue to increase; but rubber, which was exported to the value of over £1,700,000, forms nearly nine-tenths of the total.

Congo State—Katanga. **Lemaire.**

Mission Scientifique du Ka-Tanga. Journal de Route. Section Moliro—M'pwéto—Ka-Béça—Lofoï—Chutes Ki-Oubo. Par le Capitaine Lemaire Charles. Bruxelles: P. Weissenbruch, 1902. Size 13 × 10, pp. xii. and 344. *Illustrations. Presented by the Author.*

This is the first section of the route-journal kept from day to day by Captain Lemaire during the Belgian-Katanga expedition. Besides the incidents of the journey, it contains miscellaneous jottings on the methods of work employed, the productions of the country traversed, its inhabitants and their customs, the meteorological conditions, etc. A striking feature is the reproduction, in colours, of the sketches by M. Dardenne, the artist of the expedition, both of the landscapes and the animal and vegetable life of the country. The work will, when complete, be a valuable addition to our knowledge of Central Africa. Captain Lemaire's route-map (also in course of publication) is noticed elsewhere (p. 567, *infra*).

Egyptian Sudan. *Ann. G.* **11** (1902): 315–338. **Dyé.**

Le Bahr el Ghazal, notions générales sur la province, les rivières, les plateaux et les marais. Par A. H. Dyé. *With Maps and Illustrations.*

French Congo. **Ancel.**

Renseignements Colon., l'Afrique Française (1902): 79–94, 99–120.

La formation de la colonie du Congo français (1843–1882). Par Jacques Ancel. *With Map.*

French Congo. *Rev. Colon.* (1901): 319–351. **Bos.**

Rapport sur l'exploration de la Haute-Kotto. Par le Lieutenant Bos.

Some account of the journey was given in the *Journal* for January last (p. 89).

French Congo. **Wauters.**

Au Congo Français. Les bassins de l'Ubangi (Inférieur) and de la Sanga d'après les dernières découvertes. Par A. J. Wauters. Bruxelles: P. Weissenbruch, 1902. Size 10 × 7½, pp. 20. *Map. Presented by the Author.*

Reprinted from the *Mouvement Géographique*, Nos. 32, 33, 35, 1902.

French Guinea. *B.S.G. Marseille* **26** (1902): 95-97. **Devaux.**

Le Tankisso, affluent du Niger. Par Capitaine Devaux.

French West Africa. **Maistre.**

C. Maistre. La région du Bahr-Sara. I. Aspect du pays. II. Système hydrographique du Chari-Logone. Le Bahr-Sara ou Chari. III. Les Saras. Montpellier, 1902. Size 9 × 5½, pp. 38. *Presented by the Author.*

M. Maistre holds that the Bahr Sara (known in its upper course as the Wam) is the true head-stream of the Shari.

Gambia.

Gambia. Report for 1901. Colonial Reports, Annual No. 355. London, 1902. Size 9½ × 6, pp. 32.

German East Africa. *Globus* **82** (1902): 85-89. **Schieritz.**

Der Meruberg in Deutsch-Ostafrika und Seine Umgebung. Von Erwin Schieritz. Mit einleitenden und begleitenden Bemerkungen von Brix Förster. *With Illustrations.*

German Protectorate. *Beiträge Kolonialpolitik* **3** (1901-2): 617-631. **Schwabe.**

Die Verkehrsverhältnisse in den deutsch-afrikanischen Schutzgebieten. Vom Geh. Regierungsrat a. D. Schwabe.

Gold Coast. **Morris.**

Northern Territories of the Gold Coast. Report for 1901. Colonial Reports, Annual No. 357, 1902. Size 9½ × 6, pp. 22. *Price* 1½*d.*

The discovery of gold in the Northern Territories must lead, it is said, to the opening of the Volta to navigation. When this is done communication with Gambaga will be much facilitated, a good road having already been made thither from Salaga.

Kamerun. *Deutsch. Kolonialblatt* **13** (1902): 291-293, 313-315. **Hoesemann.**

Expedition des Stabsarztes Hoesemann längs der Südgrenze von Kamerun. *With Map.*

See note in the August *Journal* (p. 231).

Liberia. **Cromie.**

Trade of Liberia for the year 1901. Foreign Office, Annual No. 2875, 1902. Size 10 × 6. *Price* ½*d.*

It is hoped that something will at last be done to open up some portion of the republic through the operations of the Company known as the "West African Gold Concessions, Limited."

Madagascar. *B.S.G. Com. Paris* **24** (1902): 21-31. **Besson.**

L'avenir agricole des hauts plateaux de Madagascar. Par M. le Dr. Besson.

Madagascar. *B.S.G. Marseille* **26** (1902): 38-55. **Besson.**

Madagascar, pays Betsiléo et sud de l'île, conférence de M. le Dr. Besson.

Madagascar. *Rev. Scientifique* **18** (1902): 97-102. **Grandidier.**

Madagascar, ses habitants, sa faune et sa flore. Par M. Guillaume Grandidier. *With Illustrations.*

Morocco. **Maclean.**

Trade of Consular District of Dar-Al-Baida for the year 1901. Foreign Office, Annual No. 2791, May, 1902. Size 9½ × 6, pp. 30. *Price* 2*d.*

Natal. **Gray.**

Colony of Natal. Report on the Mining Industry of Natal for the year 1901. By C. J. Gray. Pietermaritzburg, 1902. Size 13½ × 8½, pp. 102. *Maps, Plates, Diagrams, etc.*

The output of coal in 1901 was in excess of any previous output, no doubt owing to the demand created by the war. Mining for other minerals was, however, more or less at a standstill.

Niger. *La G., B.S.G. Paris* **5** (1902): 451-461. **Lenfant.**

La navigabilité du bas Niger. Par Capitaine Lenfant.

The preliminary results of Captain Lenfant's ascent of the Niger were noticed in the *Journal* for December, 1901 (p. 623). The present paper gives fuller details.

Nigeria.

Southern Nigeria. Report for 1900. Colonial Reports, Annual No. 353, 1902. Size 9½ × 6, pp. 24. *Price* 1½*d.*

The total trade for the year exceeded £2,200,000, the exports exceeding the imports (apart from specie) by over £100,000.

North Africa. *B.R.S.G. Madrid* **43** (1901): 324–351. **Blázquez.**

Vía romana de Tánger á Cartago. Por D. Antonio Blázquez. *With Map.*

North-East Africa. **Austin.**

Among Swamps and Giants in Equatorial Africa. An Account of Surveys and Adventures in the Southern Sudan and British East Africa. By Major H. H. Austin, C.M.G. London: C. Arthur Pearson, 1902. Size 9 × 6, pp. xii. and 354. *Maps and Illustrations. Price* 15*s. net. Presented by the Publishers.*

This will be reviewed elsewhere.

Portuguese West Africa. *B.S.G. Lisboa* **19** (1901): 471–501. **Cancella.**

Impressões de uma viagem ás Ilhas de S. Thomé e Principe. Pelo Dr. José Paulo Monteiro Cancella.

Sahara. *B. Comité l'Afrique Française* **12** (1902): 307–312. **Caix.**

La reconnaissance du lieutenant Cottenest chez les Hoggar. Par Robert de Caix. *With Map.*

On a journey south from Insalah, which revealed the existence of an easy route, east of those usually followed by caravans.

Sahara. *C. Rd.* **134** (1902): 1533–1536. **Flamand.**

Sur la présence du terrain carbonifèrien dans le Tidikelt (Archipel touatien), Sahara. Note de M. G. B. M. Flamand.

Sahara. *C. Rd.* **135** (1902): 212–214. **Flamand.**

Sur le régime hydrographique du Tidikelt (archipel Touatien), Sahara central. Note de G. B. M. Flamand.

South Africa—Irrigation. **Willcocks.**

Report on Irrigation in South Africa. By W. Willcocks. (In "Further Correspondence relating to Affairs in South Africa." July, 1902. Pp. 37–75. *Plans.*) London: Eyre & Spottiswoode, 1902. Size 13 × 8½.

Zanzibar—Agriculture. **Lyne.**

Government of H.H. The Sultan of Zanzibar. Annual Report of the Agricultural Department, 1901. Size 7½ × 6, pp. 32.

NORTH AMERICA.

Alaska—Boundary. *Contemporary Rev.* **82** (1902): 190–206. **Hodgins.**

The Alaska-Canada Boundary Dispute. By Thomas Hodgins.

The American view of this question has lately been given by Mr. Balch in the *Journal of the Franklin Institute* (vol. 153, pp. 161 *et seq.*). The present paper supports the Canadian view, and presents the facts in a somewhat different light. Stress is laid on the change of the expression "sea" in the draft treaty to "ocean" in the treaty as signed between Great Britain and Russia in 1825; on the refusal of Great Britain to accede to the 10-league limit, except as a qualification of the boundary as determined by the mountain range parallel to the coast; and on the express concession to Great Britain of free access to the ocean.

Canada—British Columbia. ———

Annual Report of the Minister of Mines for the year ending December 31, 1901, being an Account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C., 1902. Size 10½ × 7, pp. 915–1232*d.* and xxviii. *Map, Diagram, and Illustrations. Price* 50 *cents.*

The rapid development noted in the last report (*Journal*, vol. xviii. p. 624) has been fully maintained in 1901, the total output having risen from 16 to 20 million dollars. The chief increase is in lode gold and copper, the quantity of the latter being nearly three times as great in 1901 as in 1900.

Canada—Labrador. *B.G.S. Philadelphia* **3** (1902): 65–212. **Delabarre.**

Report of the Brown-Harvard Expedition to Nachvak, Labrador, in the year 1900. By E. B. Delabarre, PH.D. *With Maps and Illustrations.*

Cf. note in the August *Journal*.

Canada—Railway. *Scottish G. Mag.* **18** (1902): 486–488. **Begg.**

A Second Trans-Continental Canadian Railway. By Alexander Begg.

Mexico. *Deutsche Rundschau G.* **24** (1902): 481–486. **Lemcke.**

Im Reiche der Vulkane in Mexico. Von Heinrich Lemcke. *With Map.*

United States. *J. Geology* **10** (1902): 397–412. **Ogilvie.**

Glacial Phenomena in the Adirondacks and Champlain Valley. By I. H. Ogilvie. *With Map.*

United States. ———

Annual Reports of the Department of the Interior for the fiscal year ended June 30, 1900. Report of the Secretary of the Interior. Report of the Commissioner of the General Land Office (pp. cexxiv. and 542). Miscellaneous Reports. Part i. Bureau Officers, etc. (pp. 704). Part ii. Governors of Territories, etc. (pp. 782). Indian Affairs. Report of Commissioner and Appendices (pp. xii. and 760). Indian Affairs. Commission to the Five Civilized Tribes. Indian Inspector for Indian Territory. Indian Contracts. Board of Indian Commissioners (pp. 752). Washington, 1900. Size 9½ × 6. *Maps and Illustrations. Presented by the U.S. Department of the Interior.*

United States—Census. **King.**

Census Reports. Vol. iii. Twelfth Census of the United States, taken in the year 1900. William R. Merriam, Director. Vital Statistics. Part i. Analysis and Ratio Tables. Prepared under the Supervision of William A. King. Washington, 1902. Size 12 × 9, pp. cccxiv. and 696. *Maps and Diagrams. Presented by the Director of the Census.*

United States—Census. ———

Census Reports. Vol. iv. Twelfth Census of the United States, taken in the year 1900. William R. Merriam, Director. Vital Statistics. Part ii. Statistics of Deaths. Prepared under the Supervision of William A. King, Chief Statistician for Vital Statistics. Washington, 1902. Size 12 × 9, pp. 1056. *Presented by the Director of the Census.*

United States—Geological Survey Report. ———

Twenty-first Annual Report of the United States Geological Survey to the Secretary of the Interior, 1899–1900. In Seven Parts. Part i. Directors' Report, including Triangulation, Primary Traverse, and Spirit Leveling (pp. 608). Part ii. General Geology, Economic Geology, Alaska (pp. 522). Part iii. General Geology, Ore and Phosphate Deposits, Philippines (pp. 644). Part iv. Hydrography (pp. 768). Part vi. (in two vols.). (i.) Mineral Resources of the United States, 1899. Metallic Products, Coal, and Coke (pp. viii. and 656). (ii.) Non-metallic Products, except Coal and Coke (pp. viii. and 634). Washington, 1900–1901. Size 11½ × 8. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Cochabamba. **Blanco.**

Diccionario Geográfico de la República de Bolivia. Tomo Segundo. Departamento de Cochabamba. Por Federico Blanco. Con adiciones de P. Aniceto Blanco y Manuel V. Ballivián. La Paz, 1901. Size 10½ × 7½, pp. xii. and 176. *Plan. Presented by the Oficina Nacional de Inmigración, etc., La Paz.*

Brazil. *Globus* **82** (1902): 29–31, 44–46. **Schmidt.**

Reiseskizzen aus Zentralbrasilien. Von Dr. Max Schmidt.

Describes a visit to the Bakairi Indians of the Xingu headwaters.

Brazil and Bolivia. *Rev. S.G. Rio de Janeiro* **14** (1901): 3–22. **Freitas.**

Limites do Brazil com a Bolivia. Pelo Dr. Antonio de Paula Freitas.

Brazil—Vegetation. **Huber.**

Arboretum Amazonicum. Iconographie des Plantes spontanées et cultivées les plus importantes de la région Amazonienne organisée par le Dr. J. Huber. 1re et 2me Décade. Pará, 1900. Size 13 × 10. *Plates.*

The first numbers of a series of admirable photographic illustrations of the principal economic plants and types of vegetation of the Amazon region.

Central America. *Z. Ges. Erdk. Berlin* (1902): 537–552. **Seler.**

Ueber den Ursprung der mittelamerikanischen Kulturen. Von Prof. Dr. E. Seler.

Central America—Canal. ———

Monthly B. Int. Bureau American Rep. **13** (1902): 35–39.

The Isthmian Canal Law of the United States.

Central America—Volcanoes. *Z. Ges. Erdk. Berlin* (1902): 512–536. **Sapper.**

Die geographische Bedeutung der mittelamerikanischen Vulkane. Von Prof. Dr. Karl Sapper

Chile—Aconcagua, etc. **Conway.**

Aconcagua and Tierra del Fuego. A book of Climbing, Travel, and Exploration. By Sir Martin Conway. London, etc.: Cassell & Co., 1902. Size 9 × 6, pp. xii. and 252. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

This will be the subject of a review.

Falkland Islands. **Bennett.**

Falkland Islands. Report for 1901. Colonial Reports, Annual No. 356, 1902. Size 9½ × 6, pp. 18. *Price* 1½*d.*

Gran Chaco. *Globus* **81** (1902): 387–391. **Huonder.**

Die Völkergruppierung im Gran Chaco im 18. Jahrhundert. Nach der Spanischen Handschrift eines unbekannten Verfassers veröffentlicht von P. Anton Huonder, S.J.

Guatemala. **Trayner.**

Trade, Agriculture, and Finance of Guatemala for the years 1900 and 1901. Foreign Office, Annual No. 2868, August, 1902. Size 9½ × 6, pp. 46.

Porto Rico. *Science* **16** (1902): 94–109. **Fewkes.**

Prehistoric Porto Rico. By Dr. J. Walter Fewkes.

On the ancient inhabitants and their culture.

South America. **Achá.**

José Aguirre Achá. De los Andes al Amazonas, recuerdos de la Campaña del Acre. Precedido de un Prólogo del Doctor Aníbal Capriles. La Paz, 1902. Size 8½ × 5½, pp. x. and 274. *Maps and Portraits. Presented by the Author.*

The author accompanied the expedition of Colonel Montes for the pacification of the Acre territory in North-East Bolivia, and continued down the Purus to the Amazon. He gives notes on the present condition and resources of the remote Bolivian district traversed. A notice appears at p. 532, *ante.*

West Indies. *P.R.S.* **70** (1902): 423–445. **Anderson and Flett.**

Preliminary Report on the Recent Eruption of the Soufrière in St. Vincent, and of a visit to Mont Pelée, in Martinique. By Tempest Anderson, M.D., etc., and John S. Flett, D.Sc. *With Plates.*

This is noticed at p. 431, *ante.*

West Indies. *B.S.R. Belge G.* **23** (1902): 209–251. **Du Fief.**

Une Catastrophe aux Petites Antilles, en 1902, par J. Du Fief. *With Map.*

West Indies. *Quarterly J. Geolog. S.* **58** (1902): 341–367. **Spencer.**

On the Geological and Physical Development of Dominica; with Notes on Martinique, St. Lucia, St. Vincent, and the Grenadines. By Prof. J. W. W. Spencer. *With Map.*

On the Geological and Physical Development of Barbados; with Notes on Trinidad. By Prof. J. W. W. Spencer.

West Indies—Eruptions. *Nature* **66** (1902): 370–373. **Milne.**

The West Indian Eruptions. By Prof. J. Milne, F.R.S. *With Map and Illustrations.*

West Indies—Historical. **Marcel.**

Les Corsaires Français au XVI^e^ Siècle dans les Antilles, par Gabriel Marcel. (Extrait du Compte-rendu du Congrès international des Americanistes, tenu à Paris, en Septembre 1900.) Paris: E. Leroux, 1902. Size 10 × 6½, pp. 32. *Presented by the Author.*

West Indies—Martinique. *Petermanns M.* **48** (1902): 133–136. **Deckert.**

Martinique und sein Vulkanismus. Von Dr. Emil Deckert. *With Map.*

West Indies—Martinique. *Ann. G.* **11** (1902): 289–294. **Gallois.**

L'éruption volcanique de la Martinique. Par L. Gallois. *With Illustrations.*

West Indies—Martinique. *C. Rd.* **135** (1902): 451–454. **Lacroix.**

Sur les roches rejetées par l'éruption actuelle de la montagne Pelée. Note de A. Lacroix.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Great Barrier Reef. *G.Z.* **8** (1902): 369–379. **Lendenfeld.**

Das grosse australische Wallriff. Von R. von Lendenfeld.

Australia—Meteorology. **Wragge.**

1902. Queensland. No. 1. Report on the Mount Kosciusko Observatory and Allied Stations. By Clement L. Wragge. 1898. Brisbane: G. A. Vaughan, 1902. Size 13 × 8½, pp. 26. *Charts and Illustrations.*

Australia—Year-Book. ——

The Year-Book of Australia for 1902. London, Sydney, etc. Not dated. Size 8½ × 5½, pp. lviii. and 832. *Maps.* *Price* 10*s.* 6*d.* *Presented by the Agent-General for New South Wales.*

New Caledonia. **Reichenbach.**

Trade of New Caledonia for the year 1901. Foreign Office, Annual No. 2891, 1902. Size 9½ × 6, pp. 12. *Price* 1*d.*

New South Wales. **Coghlan.**

New South Wales. Statistical Register for 1900 and previous years. Compiled from Official Returns by T. A. Coghlan. Sydney: W. A. Gullick, 1902. Size 10 × 6, pp. viii. and 1054. *Price* 5*s.* *Presented by the Agent-General for New South Wales.*

Oceania. *B.S.G. Lille* **37** (1902): 409–434; **38** (1892): 23–44. **Gallois.**

La France en Océanie. Par M. Eugène Gallois. *With Maps and Illustrations.*

Queensland—Darling Downs. **Morgan.**

The Discovery and early Development of the Darling Downs. By the Hon. Arthur Morgan. Size 9½ × 6, pp. 87–116.

Queensland—Geology. **Cameron.**

Queensland Gov. Mining J. **2** (1901): 420–421, 469–471.

Geological Observations in North-Western Queensland. By Walter E. Cameron. *With Illustrations.*

Queensland—Mineral Resources. ——

Mineral Resources of Queensland: containing a concise history of Mining in Queensland, with a description of the extensive Mineral Resources of the State, and of the wide field which they offer for investment. (*Queensland Government Mining Journal.* Special Number for the Glasgow International Exhibition.) Brisbane: Gordon & Gotch, 1901. Size 12½ × 10, pp. 66. *Maps and Illustrations.*

Tasmania. *Papers and P.R.S. Tasmania* (1900–1901): xxv.–xxxiii. **Beattie.**

Notes on a Trip to the Barn Bluff Country. By J. W. Beattie.

Tasmania. ——

Report of the Surveyor-General and Secretary for Lands for 1899–1900. Hobart: John Vail, 1900. Size 13 × 8½, pp. 54.

Ditto for 1900-1901. Pp. 48. *Map.*

POLAR REGIONS.

Antarctic—German Expedition. ——

Deutsche Südpolar-Expedition auf dem Schiff "Gauss" unter Leitung von Erich von Drygalski. Bericht über die wissenschaftlichen Arbeiten auf der Fahrt von Kapstadt bis zu den Kerguelen 27. November 1901 bis 2. Januar 1902 und die Thätigkeit auf der Kerguelen-Station bis 2. April 1902, mit Beiträgen von Bidlingmaier, v. Drygalski, Gazert, Ott, Philippi, Ruser, Vanhöffen, Werth. Heft 2, August 1902. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin.) Berlin: E. S. Mittler und Sohn. Size 10½ × 7½, pp. vi. and 74. *Charts and Illustrations.* *Presented by the Institute.*

This will be specially noticed.

Antarctic—Swedish Expedition. *Petermanns M.* **48** (1902): 138–140. **Wichmann.**

Die schwedische Südpolar-Expedition. Nach Briefen von Dr. O. Nordenskjöld und Leutnant Duse. Von H. Wichmann.

MATHEMATICAL GEOGRAPHY.

Astronomy. ——

Connaissance des Temps ou des Mouvements célestes, pour le méridien de Paris, à l'usage des Astronomes et des Navigateurs pour l'an 1903, publiée par le Bureau des Longitudes. (Pp. viii., 834, and 108.) Ditto 1904. (Pp. viii., 836, and 110.) Paris: Gauthier-Villars, 1900–1901. Size 9½ × 6. *Diagrams.*

Cartography. *G.Z.* **8** (1902): 65–80, 145–160, 204–222. **Peucker.**

Drei Thesen zum Ausbau der theoretischen Kartographie. Von Dr. Karl Peucker. *With Plate.*

Compass. **Bertelli.**

P. Timoteo Bertelli. Sulle Recenti Controversie intorno all' Origine della Bussola Nautica. (Estratto dalle Memorie della Pontificia Accademia Romana dei Nuovi Lincei, vol. xx.) Roma: Filippo Cuggiani, 1902. Size 11½ × 7½, pp. 52. *Presented by the Author.*

This will be noticed elsewhere.

Navigation. **Law.**

'Diagrams on Work Books v. Diagrams on Mercator Charts,' and 'A Short and Easy Method of finding the Centring Error of a Sextant.' By Edward Downes Law. (From the *Nautical Magazine* for 1902.) Size 9½ × 6. *Presented by the Author.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Glacial Deposits. *Rev. Scientifique* **18** (1902): 367–370. **Meunier.**

Les galets striés et les terrains d'origine glaciaire. Par Stanislas Meunier.

The writer considers that the extent of glacial deposits on the margin of the Alps and other mountain chains is commonly much exaggerated.

Ice-erosion. **Arçtowski.**

Note complémentaire au sujet de la discussion de la question de l'abrasion glaciaire. Par Henryk Arçtowski. (Extrait du *Bulletin de la Société Belge de Géologie*, etc. Tome xvi., 1902, pp. 61–63.) Size 10 × 6½.

Meteorology. *Sitzb. K.P.A.W. Berlin* (1902): 495–504. **Assmann.**

Ueber die Existenz eines wärmeren Luftstromes in der Höhe von 10 bis 15km. Von Prof. Dr. Richard Assmann.

Meteorology. *Meteorolog. Z.* **19** (1902): 260–269. **Hann.**

W. v. Bezold: "Ueber Klimatologische Mittelwerthe für ganze Breitekreise." Referat von J. Hann.

Oceanography. **Forch, Knudsen, and Sørensen.**

Mém. A.R. Sci., etc., Danemark **12** (1902): 1–152.

Berichte über die Konstantenbestimmungen zur Aufstellung der hydrographischen Tabellen von Carl Forch, Martin Knudsen, und S. P. L. Sørensen. Gesammelt von Martin Knudsen. *With Diagrams.*

Gives the results of determinations undertaken in response to a vote of the 1899 Conference on International Oceanographical research.

Oceanography. *Rev. Scientifique* **17** (1902): 545–555. **Thoulet.**

La circulation océanique. Par M. J. Thoulet.

Oceanography—Deposits. *Rev. Maritime* **154** (1902): 1155–1167. **Thoulet.**

Considérations relatives à l'analyse des fonds marins. Par J. Thoulet. *With Diagram.*

Physical Geography. *Naturw. Wochenschrift N.F.* **1** (1902): 385–391. **Günther.**

Der Erdkörper als Organismus; ein Beitrag zur Geschichte der Irrlehren in der physikalischen Geographie. Von Prof. Dr. Sigmund Günther.

Physical Geography. **Marchi.**

L. De Marchi. Trattato di Geografia Fisica. [Vol. Unico.] Milano: D. F. Vallardi, [1901]. Size 9½ × 6½, pp. xiv. and 510. *Maps and Illustrations. Price* 15 *lire. Presented by the Publisher.*

The first part treats of the internal forces which contribute to the formation of terrestrial relief in its broad outlines (continents and oceans, mountain systems, etc.); the second, of the external forces to which the individual surface forms are due. In the third, the forms themselves, their classification and evolution are dealt with. The author appears to be well acquainted with the results of modern research, and the book gives a comprehensive view of the present position of the science of geomorphology.

Physical Geography. *Geolog. Mag.* **9** (1902): 406–411. **Monckton.**

On some Examples of Marine and Subaerial Erosion. By H. W. Monckton. *With Illustration.*

Compares the marine platform at Gower and the surfaces of subaerial erosion in Surrey and Berkshire, with parallel features in Norway.

Phyto-geography. **Engler and Drude.**

Die Vegetation der Erde. Sammlung pflanzen-geographischer Monographien herausgegeben von A. Engler und O. Drude. Vols. i.–vi. Leipzig: W. Engelmann, 1896–1902. Size 10½ × 7. *Maps and Illustrations.*

This valuable series of monographs, brought out under the auspices of two of the leading authorities on the subject, will supply the student of botanical geography, in the modern conception of the term, with an indispensable basis of study. Each volume deals with the conditions of vegetation in a special region, and the titles of the recent issues are entered above, under the countries to which they refer.

Phyto-geography. *Scottish G. Magazine* **18** (1902): 406–413. **Hardy.**

A Note upon the Methods of Botanical Geography. By Marcel Hardy.

Insists on the importance of an analysis of the conditions of plant environment.

River-systems. *Globus* **82** (1902): 92–95. **Krebs.**

Wirkliche Wasserscheiden und fliegende Aufnahmen zu umfassender Orientierung über diese hydrologischen Verhältnisse. Von Wilhelm Krebs.

Urges the need of official hydrological surveys for the purpose of determining watersheds, and points out the way in which such can be carried out.

Terrestrial Magnetism. *Vidensk. Skrifter* (1901), No. 1: pp. 80. **Birkeland.**

Expédition Norvégienne de 1899–1900 pour l'étude des aurores boréales. Résultats des recherches magnétiques. Par Kr. Birkeland. *With Plates and Diagrams.*

A note on this will appear in the Monthly Record.

Tides. **Darwin.**

George Howard Darwin. Ebbe und Flut sowie verwandte Erscheinungen im Sonnensystem. Autorisierte Deutsche Ausgabe nach der Zweiten Englischen Auflage von Agnes Pockels. Mit einem Einführungswort von Prof. Dr. Georg von Neumayer. Leipzig: B. G. Teubner, 1902. Size 8 × 5½, pp. xxii. and 344. *Illustrations. Presented by the Publisher.*

The original English edition of this well-known treatise was reviewed in the *Journal* for 1899 (vol. xiii. p. 630). This translation, which has been made under Prof. Darwin's supervision, embodies the additional matter inserted in the second edition.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Guyot.**

Conférence Broca, 1901. Des Caractères de l'Évolution et de la Régression des Sociétés par M. Yves Guyot. (Extrait des Bulletins and Mémoires de la Société d'Anthropologie de Paris. Paris, 1901. Size 10 × 6½, pp. 20.

Historical—Columbus. **De la Rosa.**

La Solution de tous les problèmes relatifs à Christophe Colomb et, en particulier, de celui des origines ou des Prétendus Inspirateurs de la découverte du Nouveau Monde par M. Gonzalez de la Rosa. (Mémoire extrait du Compte rendu du Congrès international des Américanistes tenu en Septembre 1900.) Paris: E. Leroux, 1902. Size 10 × 6½, pp. 22. *Presented by the Author.*

To M. de la Rosa was originally due the theory as to the position of Toscanelli relatively to the discovery of America, which has since been developed by M. Vignaud (cf. *Journal*, vol. xix. p. 749). The two writers differ on some points, and M. de la Rosa here discusses some not considered by M. Vignaud.

Historical—Compass. *Riv. G. Italiana* **9** (1902): 281–298, 353–367, 409–424. **Bertelli.**

Sulle recenti controversie intorno all' origine della bussola nautica del P. Timoteo Bertelli.

Historical—Early Map. **Voynich.**

Supplement to the Eighth List of Books on Exhibition, by W. M. Voynich, 1, Soho Square, London, W. This Supplement consists of an unknown Map, with Inscription relating to the Magellan Expedition, and an unknown Portrait of Queen Elizabeth. June 10, 1902. Size 9½ × 6, pp. 957–958. *Facsimiles.*

See note in the September number (*ante*, p. 345).

Historical—Toscanelli. *Z. Ges. Erdk. Berlin* (1902): 498–511. **Ruge.**

Die Echtheit des Toscanelli-Briefes. Von Prof. Dr. Sophus Ruge.

A refutation of the main points of M. Vignaud's thesis.

Population. **Capitan and others.**

Rapports sur le Concours pour le Prix Bertillon 1901, par MM. Capitan, d'Échérac, G. Hervé, and Yves Guyot. (Extrait des Bulletins et Mémoires de la Société d'Anthropologie de Paris, 5e Serie, Tome II. Fasc. 6, 1901.) Paris, 1901. Size 10 × 6½, pp. 42.

Analyses of various papers on the laws of population and kindred subjects.

BIOGRAPHY.

Dawson. **Ami.**

A Biographical Sketch of George Mercer Dawson. By H. M. Ami. Ottawa, 1901. Size 13 × 9½, pp. 32. *Portrait. Presented by the Author.*

GENERAL.

Bibliography. **Hellmann.**

Terrestrial Magnetism and Atmospheric Electricity 7 (1902): 63–66.

Zur Bibliographie von W. Gilbert's 'De Magnete.' Von G. Hellmann.

The writer shows that there were only three editions of Gilbert's famous book, one published in London, 1600, the others at Stettin in 1628 and 1633.

Bibliography. ——

Annales de Géographie. Onzième Bibliographie Géographique Annuelle 1901. Publiée sous la direction de Louis Raveneau (September 15, 1902). Paris: A. Colin. Size 10 × 6½, pp. 320.

British Empire. **Busching.**

Die Entwickelung der handelspolitischen Beziehungen zwischen England und seinen Kolonien bis zum Jahre 1860. Von Dr. Paul Busching. Stuttgart and Berlin: J. G. Cotta, 1902. Size 9 × 5½, pp. 244. *Tables. Price 7s.*

Statistical tables are given, showing the development of trade with the colonies from 1826 onwards.

Educational. *G.Z.* **8** (1902): 465–469. **Cauer.**

Ueber die Stellung des geographischen Unterrichts am Gymnasium. Vortrag von Paul Cauer.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1902.

¼ inch:—

District map with hills, and printed in colours. 1*s.* folded in cover or flat in sheets. (Salisbury Plain.)

1 inch:—

With hills in brown or black, 74, 88, 113 (117 and 133), 126, 153, 154, 155 (engraved). 1*s. each.* Printed in colours, 153, 154, 166. 1*s. each*, folded in covers or flat in sheets.

6-inch—County Maps:—

Cambridgeshire, 9 S.E., 10 S.W., 38 S.W. **Dorsetshire,** 10 S.E., 23 S.W., 24 S.W., 26 S.W., S.E., 32 N.E., 33 N.W., 34 N.E., 35 N.W., S.W., 42 N.E., S.W., S.E., 43 N.W., S.W., S.E., 44 N.W., 49 N.E., 50 N.W., S.E., 51 S.W., 55 N.E., 56 N.E., 57 S.W. **Huntingdonshire,** 2 S.E., 3 S.W., 26 S.W. **Monmouthshire,** 8 S.E., 33 N.E. **Montgomeryshire,** 8 S.W. **Shropshire,** 2 S.W., 3 S.E., 4 (N.W. and S.W.), 5 N.E., S.E., 6 N.W., S.E., 7 N.E., S.E., 8 N.W., S.W., S.E., 9 N.W., N.E., S.W., 11 N.E., 12 N.E., 13 S.W., 16 S.W., 18 N.E., 19 N.W., N.E., S.E., 20 N.W., 21 N.W., 22 S.W. **Staffordshire,** 44 N.W., S.E., 45 S.E., 46 N.E. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, VII. 3; VIII. 13; XXIII. 9, 13, 14; XXV. 14; XXVI. 7, 8, 10, 11, 15; XXVII. 1, 5; XXIX. 1, 2, 4, 5, 6, 8, 9, 10, 13, 14, 16; XXX. 3, 4, 6, 7, 8, 10, 11, 13, 14; XXXIII. 11, 12, 15; XXXVI. 9, 13, 14; XXXVIII. 4, 16; XLII.

5, 6, 9; LII. 2, 15, 16. **Cardiganshire,** VIII. 12; XII. 11. **Dorsetshire,** XXII. 1, 5, 6; XXXVIII. 8, 12; XXXIX. 1, 2, 3, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16; XL. 10, 11, 12, 13, 14; XLVI. 4; XLVII. 2, 3, 4, 7, 8, 9, 10, 11, 12, 15, 16; LIII. 1, 2, 3, 5, 7, 9, 10. **Gloucestershire,** XXX. 14; XXXI. 11, 12, 15; XXXIV. 15; XXXVI. 1, 4, 5, 8, 15; XXXVIII. 3, 4, 6, 8, 12; XXXIX. 4; XL. 3, 4, 8; XLVII. 6, 16; XLIX. 7; LIX. 3, 6; LXI. 9. **Montgomeryshire,** XXIV. 14; XXXI. 1, 9; XXXVI. 12, 13, 14; XXXVII. 1, 2, 5; XLI. 11, 12, 13, 14, 16; XLII. 4, 5, 6, 7, 9, 10, 11, 12, 14; XLIII. 2, 3, 6; XLVI. 8, 12; XLVII. 4; XLVIII. 1. **Shropshire,** XXXIV. 10, 16; XXXV. 16; XXXVI. 11; XXXVII. 13; XXXIX. 14, 15; XL. 13; XLI. 4, 8, 12, 13, 14, 15; XLII. 4, 7, 8, 10, 12, 13, 14, 15, 16; XLIII. 1, 2, 3, 4, 8, 9, 10, 12, 13, 15, 16; XLIV. 2, 11; XLVII. 1, 9; XLIX. 3, 7, 10; L. 1, 2; LI. 2. **Staffordshire,** XXII. 6, 10; XXVIII. 1, 2; XXXV. 3, 8, 12; LXIII. 2, 3; LXXV. 5. **Suffolk,** XXXI. 9, 13, 14; XLII. 5, 6, 9. **Worcestershire,** IX. 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16; XV. 1, 2, 6, 7, 8, 9, 10, 11, 12. **Yorkshire,** CCXC. 2, 4, 5, 6; CCXCI. 12; CCXCVI. 14, 15; CCXCVII. 1, 2. *3s. each.*

Miscellaneous Maps.

Petty Sessional Divisions in colour, ½-inch scale, Carmarthenshire, Dorset. *6d. each.* (*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

Maps (1-inch). Old Series. Sheet 64 (Drift Edition). *Price* 8*s.* 6*d.*

England and Wales. **Bartholomew.**

Reduced Ordnance Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Sheet 10, Lincoln Wolds. Edinburgh: John Bartholomew & Co. *Price* 2*s. Presented by the Publishers.*

France. **Barrère.**

France: Carte des rivières navigables et des canaux exécutés, en construction et projetés. Scale 1 : 1,390,000 or 21·9 stat. miles to an inch. Paris: Henry Barrère. 1902.

A useful map for general reference, showing navigability of rivers, canals, railways, &c., in different colours. There is an inset plan of the environs of Paris on an enlarged scale.

Hungary. **Direction Generale R. H. des Postes et des Telegraphiques, Budapest.**

Carte postale et télégraphique des Pays de la Couronne de Hongrie. Scale 1 : 400,000 or 6·3 stat. miles to an inch. 1902. 8 Sheets and Index. Budapest: La Direction Générale R. H. des Postes et des Telegraphiques. *Presented by Robert Kaye Gray, Esq.*

An outline map on eight sheets, each measuring 34 × 24 inches, showing postal and telegraph communications in the kingdom of Hungary. A full explanation is given of the symbols employed, from which it will be seen that a great deal of information can be obtained from the map concerning railways, roads, telegraphs, telegraph stations, and other similar matters. Administrative divisions are indicated, but—very properly in a map of this kind—no attempt has been made at hill shading.

United Kingdom. **Geological Survey.**

Summary of progress for 1901. 1*s.*

(*E. Stanford, London Agent.*)

ASIA.

Asia Minor. **Diest.**

Karte des nordwestlichen Kleinasien in vier Blättern, nach eigenen Aufnahmen und unveröffentlichtem Material auf Heinrich Kiepert's Grundlage neu bearbeitet. Von Walther v. Diest. Uberst a. D. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Sheet D. Berlin: Alfred Schall. *Price 5m. each sheet.*

This is the south-east and concluding sheet of Colonel Diest's map of North-West Asia Minor in four sheets, and shows the railway between Eski-Shekir and Konia, with the surrounding neighbourhood. The whole map includes the area between 37° 30′ and 42° N. lat., and 26° and 33° E. long., and is compiled from the author's own surveys and unpublished materials, based upon Kiepert's well-known map of Western Asia Minor.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr.

Richard Kiepert. Sheets: A. v. Ünie; D. iv. Adana. Berlin: Dietrich Reimer (Ernst. Vohsen), 1902. *Price 6m. each sheet.*

Including the above, there are now altogether seven sheets published of this excellent map of Asia Minor, which will, when finished, consist of twenty-four sheets. Dr. Kiepert is evidently sparing no pains to make the map as complete as available material will allow; and although, of course, it will be necessary to correct and add to the sheets from time to time as fresh information is forthcoming, yet until a complete survey is made there is no doubt that this will be the standard map of the country. The relative value of the material upon which the map is based is shown by the style of drawing and lettering.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1:250,000 or 3·9 stat. miles to an inch. (Egyptian Sudan.) Sheets: 55-E, Debba; 45-F, Merowe. (British Central Africa. Corrections and additions, June, 1902.) Sheets: (Provisional) 111-G, Dowa; (Provisional) 111-F, Fort Manning; (Provisional) 111-H, Fort Maguire; (Provisional) 111-K, Dedza Boma; (Provisional) 111-L, Mlangeni; (Provisional) 111-O, Kirk Mountains; (Provisional) 111-P, Blantyre; (Provisional) 117-D, Chiromo; (Provisional) 117-H, Sena. *Price 1s. 6d. each sheet.* Scale 1:1,000,000 or 15·7 stat. miles to an inch. Sheets: 69, North-East Somaliland; 80, South-West Somaliland; 81, South-East Somaliland, 1901. *Price 2s. each sheet.* London: Intelligence Division, War Office; Stanford. *Presented by the Director-General of Mobilization and Military Intelligence.*

These all form part of the large map of Africa now being prepared by the Intelligence Division of the War Office. The sheets of the Egyptian Sudan and British Central Africa are revised editions of those published last year. Those of Somaliland, on the 1:1,000,000 scale, are new, and complete the north-east angle of the country.

British Central Africa. **Maitre and Langhans.**

Originalkarte der Reisen der "Weissen Väter" in Lobemba und Lobisa (Britisch Zentral-Afri' a) 1899 und 1900. Nach den Entwürfen von Henri Maitre mit den Reisewegen und Aufnahmen führer Forscher vereinigt von Paul Langhans. Scale 1:1,000,000 or 15·7 stat. miles to an inch. *Petermanns Geografische Mitteilungen*, Jahrgang 1902, Tafel 16. Gotha: Justus Perthes. *Presented by the Publisher.*

Congo Free State. **Lemaire.**

Atlas de 125 à 130 feuilles, donnant l'itinéraire détaillé parcouru par la Mission scientifique du Ka-Tanga. Scale 1: 50,000 or 0·78 stat. mile to an inch. Part i. Sheets 1–27 and 84. Brussels: P. Weissenbruch, 1902. *Presented by Captain Ch. Lemaire.*

Captain Lemaire's journey from Tanganyika along the Congo-Zambezi watershed, during which the surveys forming the basis of these sheets have on several occasions been referred to in the *Geographical Journal*, and in the present number the scientific reports upon the survey are specially noticed. The present sheets consist of Nos. 1 to 27 and No. 84 of a large scale (1: 50,000) map of the route followed by the expedition, which is altogether to consist of about 125 to 130 sheets, each measuring 21 × 28 inches. They are somewhat diagrammatic in appearance, but exhibit very clearly an amount of detail and information that could not be shown on a small scale, together with useful notes upon the character of the country, water obtainable, animal and vegetable life, and other subjects. Still a good proportion of each sheet consists of blank paper, and it would perhaps have been better, and certainly more convenient for reference, if the map had been drawn on a somewhat smaller scale than 1: 50,000, and the longer notes printed at the sides with a reference number to indicate the exact spot to which they refer. A general map of the journey was published last year, in two sheets, on the scale of 1: 1,000,000. The present map accompanies the narrative, which is now being published in parts.

Egypt. **Schweinfurth.**

Aufnahmen in der Östlichen Wüste von Ägypten von George Schweinfurth. I Serie (10 Blätter). Dritte Lieferung, Blatt 6. Die krystallinischen Küstengebirge am Roten Meere zwischen 26° 40′ u. 27° 31′ n. Br. Scale 1: 200,000 or 3·1 stat. miles to an inch. Blatt 10*a*. and 10*b*. Die Wüstenregion zwischen Nil und Rotem Meer nördlich von der Keneh-Gosser Strasse zwischen 25° 50′ und 26° 50′ n. Br. Scale 1: 200,000 or 3·1 stat. miles to an inch. Berlin: Dietrich Reimer (Ernst Vohsen). 1902.

The third portfolio of maps of this series, which has just been published, shows on

sheet VI. the results of the surveys of Dr. Georg Schweinfurth in the Eastern Desert of Egypt, approximately between 26° 40′ and 27° 30′ N. lat., and between the Wadi Kench and the Red Sea; and on sheets X*a*. and X*b*., the region between 25° 50′ and 27° 30′ N., and from the Nile at Keneh to the Red Sea. According to the index, there are only two other sheets required to complete the series. The basis of the map is the triangulation and route surveys conducted by Dr. G. Schweinfurth during the years 1877, '78, '84, and '85, and whenever other authorities have been utilized the fact is mentioned, and the explorer's name given. In addition to the topographical detail, many most useful and interesting notes are given respecting the geology and physical features of the country.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Map of the Dominion of Canada and Newfoundland. Scale 1 : 2,217,600 or 35 stat. miles to an inch. 8 Sheets. Ottawa: Surveyor-General's Office, Department of the Interior, 1902. *Presented by the Surveyor-General of Canada.*

This is a most useful general map on eight sheets, each of which measures about 25 × 26 inches. It thus has the advantage of being sufficiently large to show a fair amount of detailed information without overcrowding. The rapid advance of the surveys of the more remote regions of the Dominion by different members of the Canadian Survey Department and others during recent years, will be seen by comparing this map with those of earlier dates. With few exceptions, the map may be taken as showing the latest information up to date of publication. It is clearly drawn and printed in colours, showing the different political divisions.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Antler Sheet (52), West of Principal Meridian. Surveyor-General's Office, Ottawa, 1902. *Presented by the Surveyor-General of Canada.*

The area represented on this sheet, about 1300 square miles, lies just to the west of Manitoba, and to the north of the boundary between the United States and Canada. The sheet gives little detail, but is ruled into sections, and shows township numbers.

Guatemala. **Sapper.**

Die Ausbreitung des Erdbebens von Guatemala, April 18, 1902. Von Prof. Dr. Karl Sapper. Scale 1 : 1,750,000 or 27·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 17. Gotha: Justus Perthes. *Presented by the Publisher.*

Peru. **Raimondi.**

Mapa del Perú por A. Raimondi. Scale 1 : 500,000 or 6·8 stat. miles to an inch. Sheets: 15A, 15B, 19A, 19B, 23A. Paris: Erhard Frès.

These sheets include the forest area between 6° 10′ and 10° 50′ S. lat., and 61° 20′ and 67° 10′ W. long., extending on the east as far as the Rio Madeira. The boundaries between the various countries in this part of South America are far from being defined, and therefore it may be doubtful whether this region really belongs to Peru. There is little on the sheets except a few rivers, the course of which, as here laid down, can only be considered as very approximate.

United States. **U.S. Geological Survey.**

Geologic Atlas of the United States. Scale 1 : 125,000 or 1·8 stat. mile to an inch. Folio 76, Austin. Department of the Interior, United States Geological Survey, Charles D. Walcott, Director, Washington, D.C. *Presented by the U.S. Geological Survey.*

As is the case with the others of this series, this atlas consists first of a topographic map showing relief in brown contour lines at 25-feet intervals, next the historical geology sheet, which is on the same scale (1 : 125,000) as the former, and represents the same area, but shows the geological formation. After these follow two sheets of sections, and two plates of excellent photographic reproductions, illustrating characteristic geological features and fossils. The maps and plates are preceded by eight pages of explanatory text, and the whole atlas is most complete and instructive.

ARCTIC.

Greenland. **Stein.**

Einheimische Namen an der Küste von Nordgrönland von Cap York bis Smith Sound, von Robert Stein. Scale 1 : 1,200,000 or 18·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 18. Gotha: Justus Perthes. *Presented by the Publisher.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July and August, 1902. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3275 m	= 4·0	Ireland, west coast:—Blacksod bay. 2*s.* 6*d.*
1458 m	= var.	Spain:—Ports and anchorages on the east coast of. Plans added:—Cullera anchorage, P. Dénia, Benicasim road, Columbretes islands. 1*s.* 6*d.*
3276 m	= 0·38 / 1·99	Balearic islands:—Iviza and Formentera islands and channel between Iviza and Espalmador. 1*s.* 6*d.*
3277 m	= 6·0	Balearic islands:—Ports San Antonio and Iviza. 1*s.* 6*d.*
3259 m	= 3·0	Newfoundland, east coast:—Green head to Little bay island. 2*s.* 6*d.*
3270 m	= 1·99	Newfoundland:—Head of Fortune bay, including Long harbour. 2*s.* 6*d.*
3204 m	= 1·8	United States, east coast:—New York bay and harbour. 2*s.* 6*d.*
3286 m	= 0·25	South America, east coast:—Rio de San Francisco do Norte to river Tariri. 2*s.* 6*d.*
3260 m	= 1·99	British Columbia:—Johnstone strait. 2*s.* 6*d.*
3284 m	= 3·98	India, west coast. Gulf of Kutch:—Salaya harbour. 2*s.* 6*d.*
3296 m	= 0·36 / 3·55	Eastern archipelago. Plans in Timor:—Koepang bay and approaches, Koepang road, Hansisi anchorage. 1*s.* 6*d.*
3294 m	= 6·0	Yang tse kiang:—Hankau. 1*s.* 6*d.*
3163 m	= 5·7	Japan, south-east coast:—Nipon island, Katsuura wan. 1*s.* 6*d.*
199		Adriatic:—Brindisi to Ortona. New plan:—Vieste.
421		Newfoundland:—Plans on the east coast of. Plan added:—Toulinguet harbours.
2141		Newfoundland, south coast:—Richards harbour to Ramea island. Plans added:—Heads of White Bear, Hare, and Recontre bays.
3016		Newfoundland, west coast:—Cow head to Rich point. Plan added:—Bad bay.
220		Newfoundland, north-west coast:—Savage cove to St. Barbe bay. Plans added:—Flower cove, St. Barbe harbour.
2923		Australia, east coast:—Hope islands to Turtle group. New plan:—Cook's passage.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1187	Port Iviza. Plan on this chart.	New plan on sheet	3277
1465	Anchorages on the east coast of Spain.	New chart	1458
288	Toulinguet harbours.	New chart	421
935	Koepang bay, Koepang road. Coaling station anchorage on this sheet.	New chart	3296

Charts that have received Important Corrections.

No. 1828, England, east coast:—The Downs. 2693, England, east coast:—Orwell and Stour rivers. 2053, Ireland, south coast:—Kinsale harbour and Oyster haven. 2745, France, west coast:—Ile de Bas and adjacent coast. 710, Spain, Anchorages on the north coast:—Port Castro Urdiales. 2233, Black sea, Sheet IV.:—Sevastopol to Kertch strait. 2205, Black sea:—Kertch strait. 2978, Iceland:—Sigle fiord to Niardvig. 2979, Iceland:—Niardvig to Storksnœs. 2980, Iceland:—Storksnœs to Portland. 2042, North America, Gulf and River St. Lawrence:—Sydney harbour. 2579, Cuba, western portion. 495, Martinique:—St. Pierre roadstead. 892, South America, east coast:—Maccio to Rio de San Francisco do Norte. 21, South America, Chile:—Channels between Gulf of Trinidad and Gulf of Peñas. 2840, British Columbia:—Haro strait and Middle channel. 1835, British Columbia:—Clayoquot sound. 1844, Borneo:—Labuan island. 3148, Celebes:—Salabangka strait. 999, Gulf of Siam:—Menam Chau Fya or Bangkok river. 1258, Korea:—Approaches to Séoul. 2265, Japan:—Kobé and Hyogo bays. 1011, Russian tartary:—Eastern Bosphorus strait (Hamelin strait). 2130, Tasmania:—Port Davey. 2922, Australia, east coast:—Turtle group to Claremont point.

1896, New Zealand:—Auckland harbour entrances. 1423, New Zealand:—Port Nicholson.

(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for October, 1902. London: Meteorological Office. *Price* 6*d*. *Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September and of the North Pacific Ocean for October, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bahr-el-Ghazal. **Hughes.**

Twenty-three photographs of the Bahr-el-Ghazal region, taken by Major H. M. Hughes. *Presented by Major H. M. Hughes.*

These are interesting photographs, especially as representing the Dinkas and other natives of the Bahr-el-Ghazal. They also give a good idea of the character of the country.

(1) Sudanese troops; (2) Dinkas; (3) Dinkas at Toug; (4) Dinkas at Wau; (5) Dinka Sheik and wives; (6) Dinka dug-out canoe; (7) Ivory war-horns of the Dinkas; (8) Jur woman carrying water; (9) Jur fisherman; (10) Jur boys at Wau; (11) Golo Sheiks and musical box; (12) Golo hut; (13) Golo family; (14) Sultan Tumbura, Niam Niam chief; (15 and 16) Niam Niam warriors; (17) Niam Niam coiffure; (18) Dhurra; (19) Forest at Wau; (20) Charge of Agai warriors; (21) Agai huts on piles; (22) *Balœiceps Rex*; (23) Native beehive, common all over the Bahr-el-Ghazal.

British Guiana. **Case.**

Seven photographs of British Guiana, taken by C. B. Case, Esq. *Presented by Frank J. Gray, Esq.*

A series of small platinotypes, specially interesting geographically from the fact that they show the different methods employed for protecting the foreshore from encroachments of the sea. The result of sedge-grass planting for this purpose is well exhibited. They are as follows:—

(1 and 2) Plantation Hope, Demerara; the foreshore, showing fascine protection works; (3 and 4) the foreshore, Golden Fleece, Essequibo; (5) Plantation La Bonne Intention, Demerara, showing main drainage canal and sluice; (6) Plantation Lusignan, Demerara; (7) Golden Fleece buildings (sugar factory), Essequibo.

Congo Region. **Grenfell.**

Twenty-nine photographs of the Congo Region, taken by the Rev. G. Grenfell. *Presented by the Rev. G. Grenfell.*

These photographs vary in size and merit, but some of them are decidedly good. They illustrate the features of the lower Congo region, the natives, and the work of the Baptist Missionary Society, in the cause of which the Rev. G. Grenfell has so long laboured—

(1) Steamer workshops, Bolobo; (2) Ngoie, chief of Bolobo; (3) Funeral dance, Bolobo; (4) Chief house, Bolobo; (5) The first installation of the Baptist Mission Society at Bolobo; (6) S.S. *Goodwill* on the slips at Bolobo; (7) Mission Station, Bolobo, Haut Congo: S.S. *Peace* on the slips; (8) Hauling up the s.s. *Peace* for repairs, Bolobo; (9) The s.s. *Peace* in front of the workshop, Bolobo; (10) Hua, the s.s. *Peace* pilot; (11) The first sternwheel steamer on the upper Congo, built by Yarrows; (12) The first steamer on the upper Congo, the *En Avant*; (13) View showing masonry of old city wall of San Salvador; (14) Herbert Ward and the remains of the Emin Pasha Relief Expedition rear guard, off Lukolela; (15) Native view of the Lulongo banks; (16) Bobangi trading flotilla, Lukolela; (17) Bobangi chief, attendant, and wives; (18) Bobangi women (early stage of civilization); (19) Bwela people; (20) Upoto man; (21 and 22) River Kwango above Kingunji; (23) Rapids of the Congo from the Leopoldville hill; (24) Houses at Bwela; (25) Congo railway at the confluence of the Mpozo river with the main stream: (26) The prison, Basoko; (27) Stanley Falls; (28) Lupu, chief of Banalya, upper Aruwimi; (29) Street, Banalya, upper Aruwimi.

Tahiti. **Homes.**

Four photographs of the Cook Memorial in Tahiti, with plate sent out by the

Royal Society and Royal Geographical Society, 1901, taken by F. Homes, Esq. *Presented by R. T. Simons, Esq., H.B.M. Consul, Tahiti.*

It will doubtless be remembered that last year this Society, in conjunction with the Royal Society, decided to send an inscribed plate to be placed upon the Cook memorial at Tahiti, which had been restored, and which commemorates the observation of the transit of Venus near this spot by the famous navigator on June 3, 1769. These photographs show the memorial as restored, with the plate attached.

(1) Point Venus lighthouse, Cook's memorial on the left; (2) Cook's memorial restored, general view; (3) Royal Society and Royal Geographical Society's plate; (4) Matavai bay, Captain Cook's favourite anchoring-place in Tahiti.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

ORDNANCE SURVEY MAPS.

THE following is a list of the various Ordnance Survey Maps of the British Isles on sale to the public, together with the prices. E. Stanford, 12, 13 and 14, Long Acre, W.C., is the London agent; there are also provincial agents in most of the important towns of England, Scotland, and Ireland. In places where no agent exists, the maps can be obtained through the principal local post offices.

¼-inch Scale.

	Price per sheet. s.	d.
1. England and Wales, engraved in black, latitude and longitude marked, no hill shading or contours. Size 22½ × 15 inches. On paper . .	1	6
2.*England and Wales, engraved. Printed from a transfer from copper, hills in brown, roads sienna, water blue, woods green. Size 22½ × 15 inches. On paper	1	6
3.*Scotland, engraved. Printed from a transfer from copper, with water in blue, latitude and longitude marked, no hill shading or contours. Size 18 × 12 inches. On paper	1	0
4.*Scotland, engraved. Printed from a transfer from copper, hills in brown, roads sienna, water blue, woods green. Size 18 × 12 inches. On paper	1	0
5.*County and District Maps of Great Britain, cheap edition, roads in brown, latitude and longitude marked, on thin paper or folded in covers. In sheets. Unmounted . . . . . 6*d.* and	1	0
Folded in covers . . . . . 9*d.* and	1	0

1-inch Scale.

6. England and Wales, old series, in black, with outline and hill hachures. Size 36 × 24	2	6
Size 18 × 12	1	0
7. Ditto, new series, outline, contours in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
8.*Ditto, hills hachured in brown, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
9.*Ditto, hills hachured in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
10.*Ditto, hills hachured in brown, contours red, roads sienna, water blue, magnetic variation shown, latitude and longitude not marked. Size		

* Publication in progress.

	Price per sheet. s.	d.
18 × 12 inches. On linen-backed paper, either flat (with a few exceptions) or folded in covers. Single sheets	1	0
Combined sheets	1	6
11. Scotland, outline and contours in black, latitude and longitude marked. Size 24 × 18 inches. On paper	1	9
12.*Ditto, hills hachured in brown, and black contours, latitude and longitude marked. Size 24 × 18 inches. On paper	1	6
13. Ireland, outline, not contoured, in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
14.*Ditto, outline, not contoured, in black, latitude and longitude marked, showing county, rural, urban, and county borough boundaries in red. Size 18 × 12 inches	1	0
15. Ditto, hills hachured in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
16.*Ditto, hills hachured in brown, roads sienna, water blue, woods green, latitude and longitude marked. Size 18 × 12 inches. On linen, backed paper, either flat or folded in covers	1	0
17.*Combined maps of areas round certain large towns, or other areas, such as the New Forest and Lake District, and published in various forms and sizes. These maps usually show outline and contour in black and roads in brown. In sheets, unmounted . . . . . 9*d.* to	1	0
Folded in cover . . . . . 1*s.* to	1	6

6-Inch Scale.

18. Great Britain, water coloured blue or back lined, contours in black, latitude and longitude marked.		
Heliozincographed or photozincographed. Size 18 × 12 inches	1	0
Engraved or photozincographed (where not published in quarter sheets). Size 36 × 24 inches	2	6
19. Ireland, engraved or heliozincographed, contours in black, latitude and longitude not marked. Size 36 × 24 inches	2	6

$\frac{1}{2500}$ Scale.

20. Houses ruled in black, water blue or back lined, latitude and longitude not marked. Size 38 × 25½ inches	3	0
21. Houses red, water blue, roads brown, latitude and longitude not marked. Unrevised editions only coloured in this form. Size 38 × 25½ inches. From 2*s.* 6*d.* to 23*s.*, according to the amount of colouring. This form is gradually being superseded by 20.		

Town Scales.

22. $\frac{1}{500}$ scale, houses stippled. Size 38 × 25½	2	6
23. Ditto, houses ruled. Size 38 × 25½	2	6
24. Ditto, houses red, water blue, roads brown. Size 38 × 25½ inches. From 2*s.* 6*d.* to 15*s.*, according to the amount of colouring. Applies to unrevised only.		
25. 5-feet scale, houses stippled. Revised. Size 36 × 24 inches	2	6

Index Maps.

26. Indexes to the sheets of the 1-inch scale maps of England and Wales, Scotland, and Ireland, scale 30 miles to an inch. Sizes about 18 × 13 inches	0	2
27.*Index to the sheets of the 6-inch scale map, parishes coloured.		
England and Wales. Size 18 × 12 inches	1	0
Scotland. Size 24 × 18 inches	1	9
28.*Index to the sheets of the 1 : 2500 scale map, parishes coloured.		
England and Wales. Size 18 × 12 inches	1	0
Scotland. Size 24 × 18 inches	1	9

Nos. 27 and 28 are identical with Nos. 7 and 11, but with sheet lines added, printed on thin paper, and coloured to show civil parishes.

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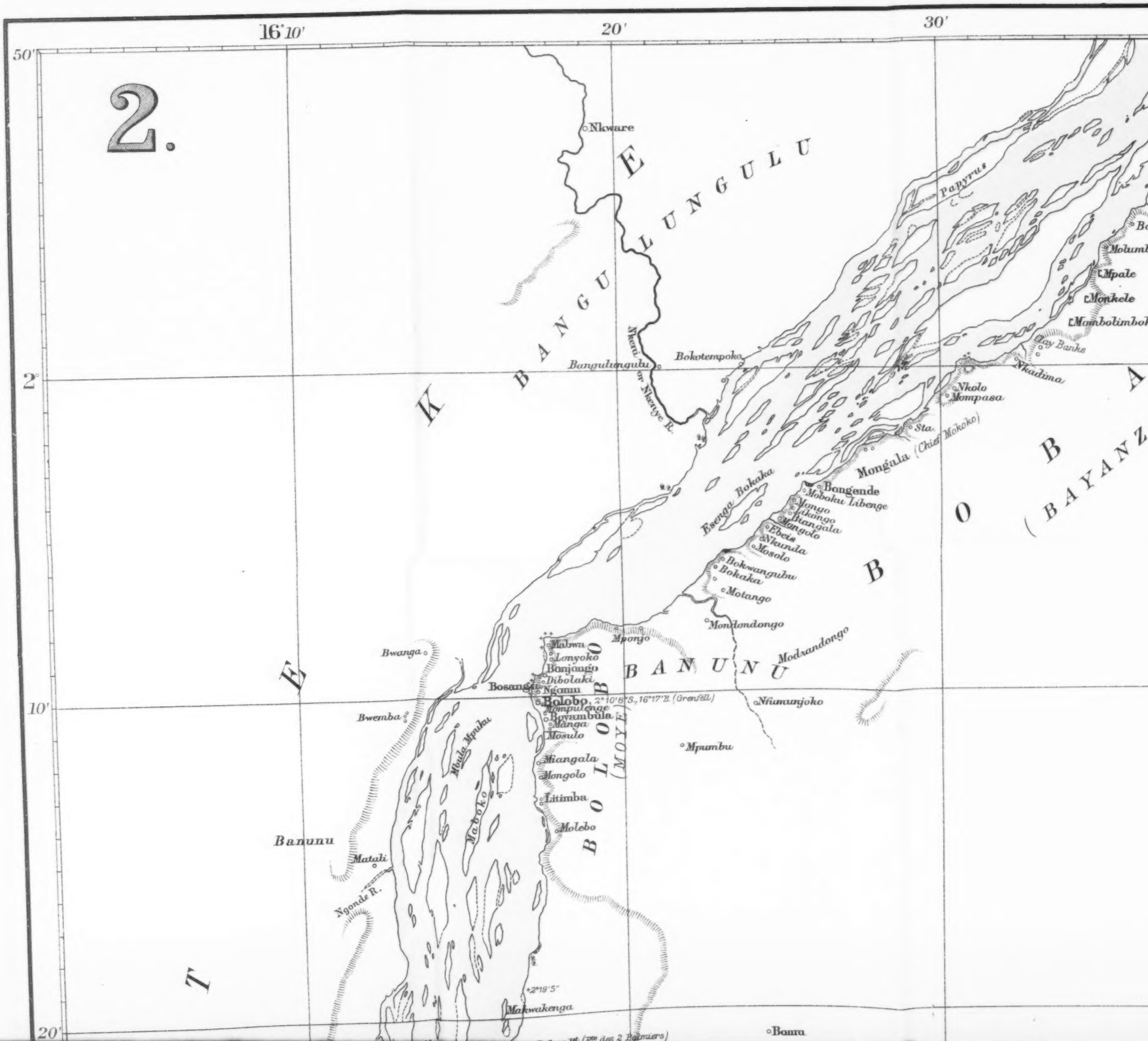
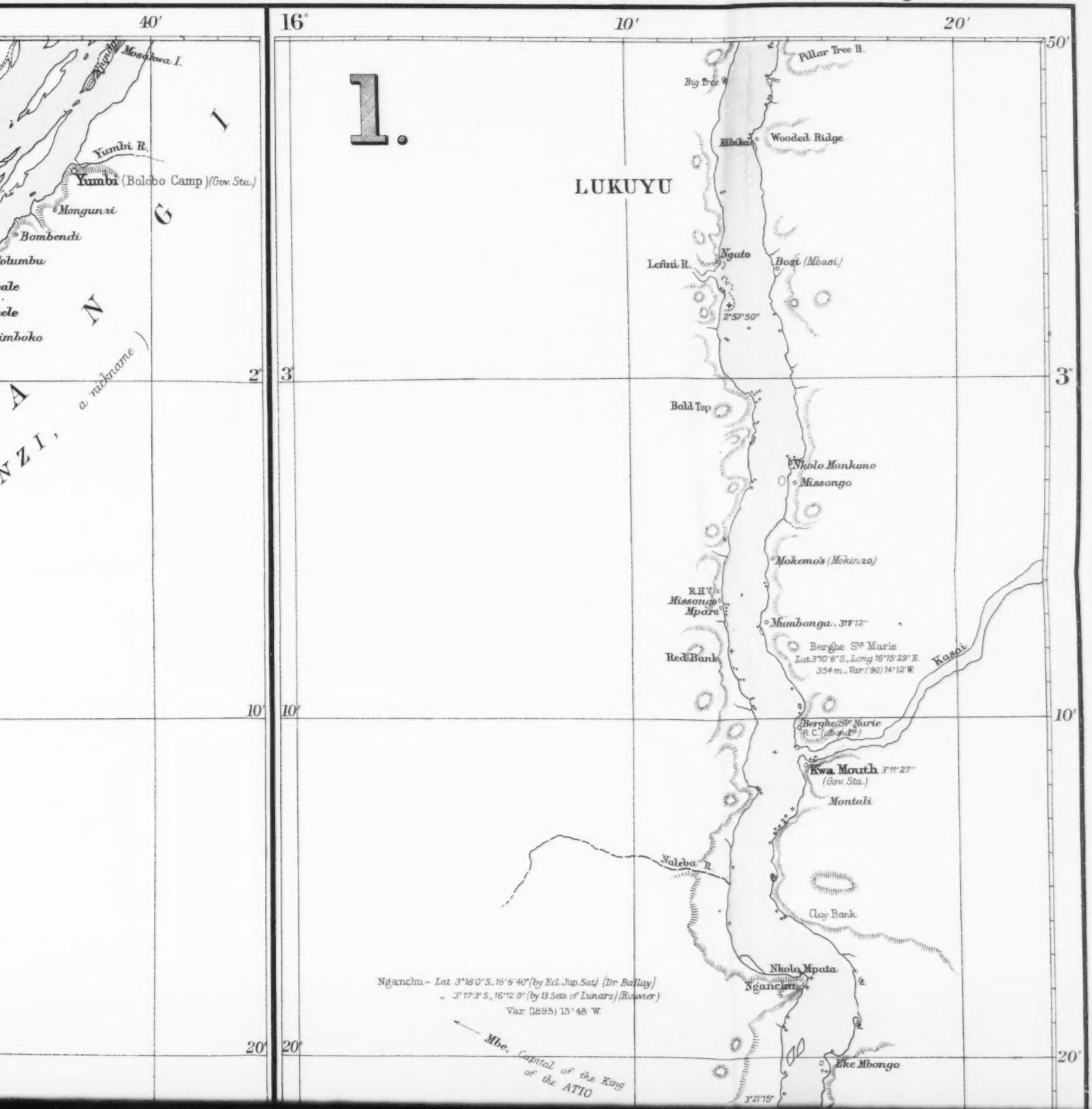
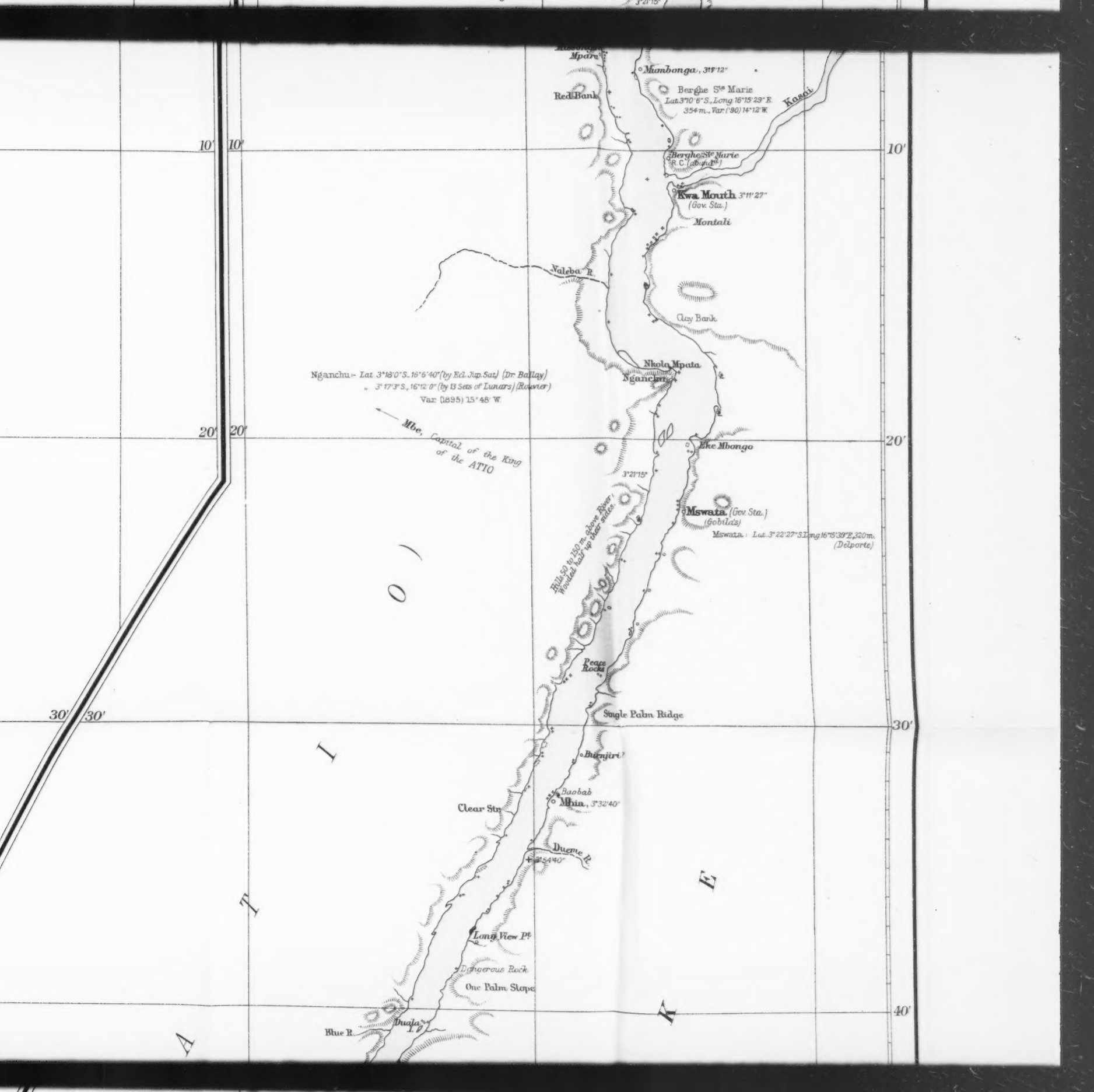
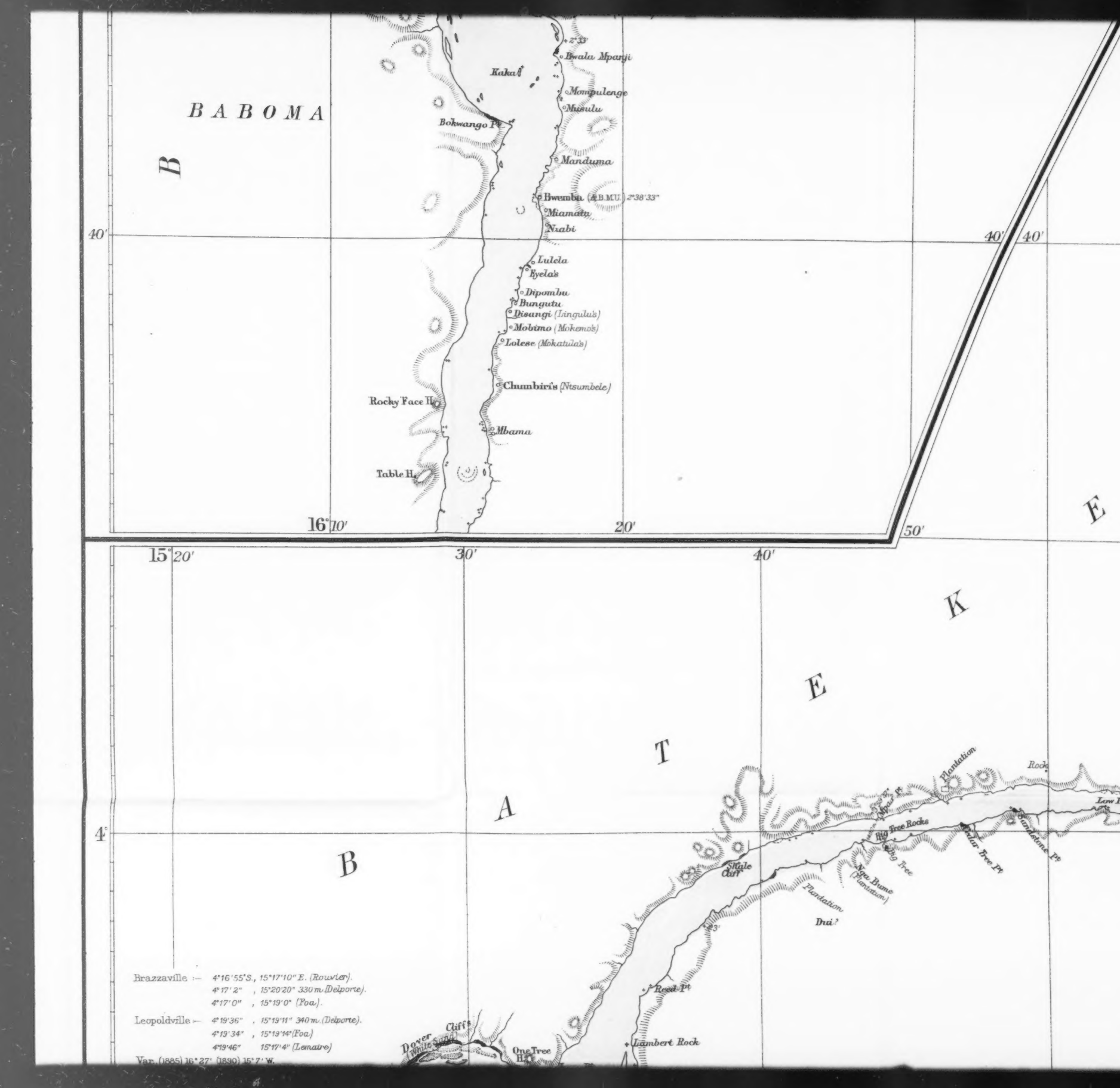
* Publication in progress.


2.
16° 10'
20'
30'
50'
2°
10'
20'
Nkware
Nkeri or Nkenye R.
Bangulungulu
Bokotempoko
Papyrus
Molumb
Mpale
Monkele
Mombolimbol
Bay Banks
Nkadima
Nkolo Mompasa
Sta
Mongala (Chief Mokoko)
Bongende
Moboku libenge
Mango
Ikango
Bangala
Mongolo
Ebeis
Nkunda
Mosolo
Dokwangubu
Bokaka
Motango
Mondondongo
Eserga Bokaka
Mponjo
Modzandongo
Bwanga
Bosange
Malwa
Lonyoko
Bonjongo
Dibolaki
Ngonu
Bolobo, 2° 10' 6" S., 16° 17' E. (Grenfell)
Mompulenge
Bonumbula
Manga
Mosulo
Nkumunjoko
Bwemba
Mpumbu
Miangala
Mongolo
Litimba
Molebo
Maka Mpuku
Nabóko
Banunu
Matuki
Ngonde R.
2° 19' 5"
Makwakenga
Bonnu
Palma Pt. (pte des 2 Palmiers)
K B A N G U L U N G U L U
B A N U N U
B O L O B O
(MOYE)
B O B A
(BAYANZ
T E


40'
Mosokwa I.
Yumbi R.
Yumbi (Bolobo Camp) (Gov. Sta.)
Mongunzi
Bombendi
2°
10'
20'
16°
10'
20'
50'
1.
LUKUYU
Pillar Tree H.
Big Tree
Elbuka
Wooded Ridge
Ngato
Bosi (Mbasi)
Lefini R.
2°57'50"
3°
Bald Top
Nkolo Mankono
Missongo
Mokemo's (Mokinzo)
R.H.V.
Missongo Mpara
Mumbonga, 3°9'12"
Berghe Ste Marie
Lat. 3°10'6" S., Long. 16°15'29" E.
354 m., Var. ('90) 14°12' W.
Red Bank
Kasai
Berghe Ste Marie
R.C. (abnd.)
Kwa Mouth 3°11'27"
(Gov. Sta.)
Montali
Naleba R.
Clay Bank
Nkolo Mpata
Nganchu
Nganchu - Lat. 3°18'0" S., 16°6'40" (by Ecl. Jup. Sat.) (Dr. Bailay)
" 3°17'3" S., 16°12'0" (by 13 Sets of Lunars) (Rouvier)
Var. (1895) 15°48' W.
Mbe, Capital of the King of the ATIO
Eke Mbongo
3°21'15"

Bokwangribu
Bokaka
Motango
Mondondongo
Mpongo
Malwa
Lonyoko
Bonjongo
Dibolaki
Ngonu
Bolobo, 2°10'S., 16°17'E. (Grenfell.)
Mompulenge
Bovambula
Manga
Mosulo
Miangala
Mongolo
Litimba
Molebo
Bosango
Bwanga
Bwemba
Mpula Mpuka
Maboko
Banunu
Matali
Ngonde R.
BOLOBO (MOYEN)
BANUNU
Modzandongo
Nfumanjoko
Mpumbu
2°19'5"
Makwakenga
Twin Palms Pt (Pte des 2 Palmiers)
Bonru
BATENDE
Hippopotamus I. — Lat. 2° 23'52" S. Long. 16°15'18" 335 m. (Delporte)
Hippopot. I.
Nsa Benge
Nduka
Mongelo
Saku
Bongwandu
Cone H.
Sandy Beach (Gov. Sta.)
2°33'
Bwala Mparji
Kaka
Mompulenge
Musulu
Bokwango Pte
Manduma
Bwemba (A.B.M.U.) 2°38'33"
Miamatu
Nzabi
Lulela
Eyela's
Dipombu
BABOMA
10'
20'
30'
40'
40'
40'


Mpara
Mumbonga, 3°9'12"
Red Bank
Berghe Ste Marie
Lat. 3°10'6" S., Long. 16°15'29" E.
354 m., Var. ('90) 14°12' W.
Kasai
10'
Berghe Ste Marie
R.C. (abandd.)
Kwa Mouth 3°11'27"
(Gov. Sta.)
Montali
Naleba R.
Clay Bank
Nkola Mpata
Nganchu
Nganchu:- Lat. 3°18'0" S., 16°6'40" (by Ecl. Jup. Sat.) (Dr. Bailay)
" 3°17'3" S., 16°12'0" (by 13 Sets of Lunars) (Rouvier)
Var. (1895) 15°48' W.
20'
Mbe, Capital of the King of the ATIO
Eke Mbongo
3°21'15"
Mswata (Gov. Sta.)
(Gobila's)
Mswata: Lat. 3°22'27" S. Long. 16°15'39" E. 320 m.
(Delporte)
Hills 50 to 150 m. above River, Wooded half up their sides
Peace Rocks
30'
Single Palm Ridge
Bienjiri
Baobab
Mbia, 3°32'40"
Clear Stn
Dueme R.
3°54'40"
Long View Pt
Dangerous Rock
One Palm Slope
40'
Duala
Blue R.
ATIO
RE


BABOMA
B
2°33'
Bwala Mparji
Kakaï
Mompulenge
Musulu
Bokwango Pt.
Manduma
Bwemba (A.B.MU.) 2°38'33"
Miamatu
Nsabi
Lulela
Eyela's
Dipombu
Bungutu
Disangi (Ingulu's)
Mobimo (Mokemo's)
Lolese (Mokatula's)
Chumbiri's (Ntsumbele)
Rocky Face Hd.
Mbama
Table Hd.
16° 10'
20'
50'
40'
40'
40'
E
15° 20'
30'
40'
K
E
T
A
B
4°
Plantation
Rock
Low
Big Tree Rocks
Big Tree
Cedar Tree Pt.
Mandalane Pt.
Shale Cliff
Nga Bume (Plantation)
Plantation
Drai?
3'
Reed Pt.
Cliffs
Dover White Sand
One Tree Hd.
Lambert Rock
Brazzaville :— 4°16'55"S., 15°17'10"E. (Rouvier).
4°17'2" , 15°20'20" 330 m. (Delporte).
4°17'0" , 15°19'0" (Foa).
Leopoldville :— 4°19'36" , 15°19'11" 340 m. (Delporte).
4°19'34" , 15°19'14" (Foa.)
4°19'46" 15°17'4" (Lemaire)
Var. (1885) 16°27' (1890) 15°7' W.

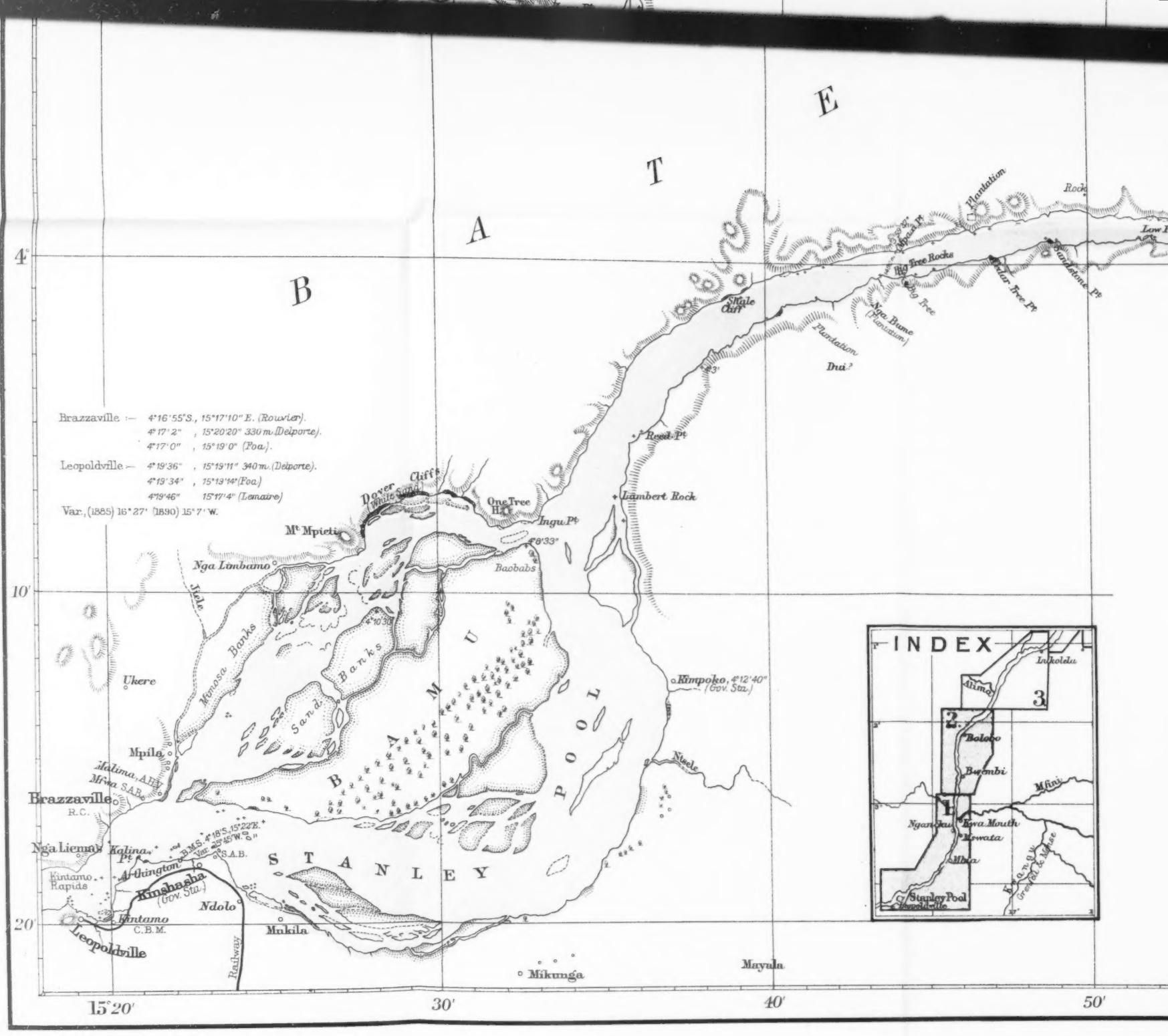
A MAP OF THE

CONGO RIVER

BETWEEN

LEOPOLDVILLE AND STANLEY FALLS,

From Running Surveys in the Steamers "PEACE" and "GOODWILL" by the



Published by the Royal Geographi

Running Surveys in the Steamers "PEACE" and "GOODWILL" by the

B

4°

A MAP OF THE

CONGO RIVER

BETWEEN

LEOPOLDVILLE AND STANLEY FALLS,

From Running Surveys in the Steamers "PEACE" and "GOODWILL" by the

Rev. GEORGE GRENFELL, B.M.S.

1884-89.

Scale 1:250,000.

Kilometers
0 5 10 15 20 25

Geographical or Sea Miles
0 5 10 15

Statute Miles
0 5 10 15

10'

The Courses and Outlines have been laid down from some 200,000 Cross-bearings taken with a 6-inch Azimuth Compass, by Hughes of Fenchurch Street, examined at Kew. Deviation being applied by "Swinging the Ship" from time to time.

The Altitudes observed for Latitudes numbered about 1,500, and for Time and Longitude about 1,200, about half in each case being taken with a Sextant, and the other half with a 6-inch Transit Theodolite by Cassella.

The Channels between Islands more than half a mile in length, excepting those indicated by dotted lines, have all been navigated by one or other of the Steamers.

The results of the Astronomical Observations made by Rouvier, Delporte, Foa, and Lemaire are added in marginal notes.

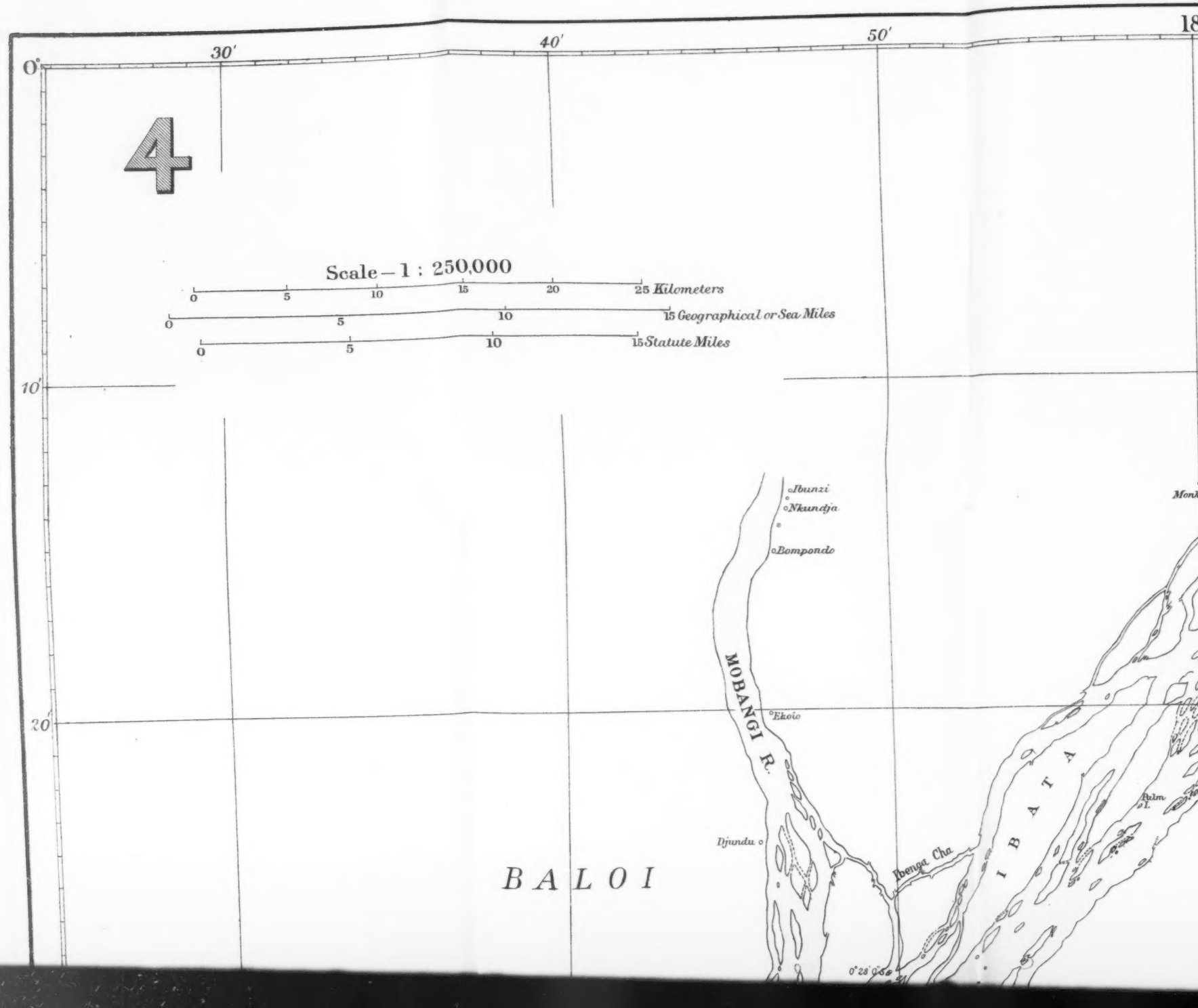
Altitudes are given in Meters.

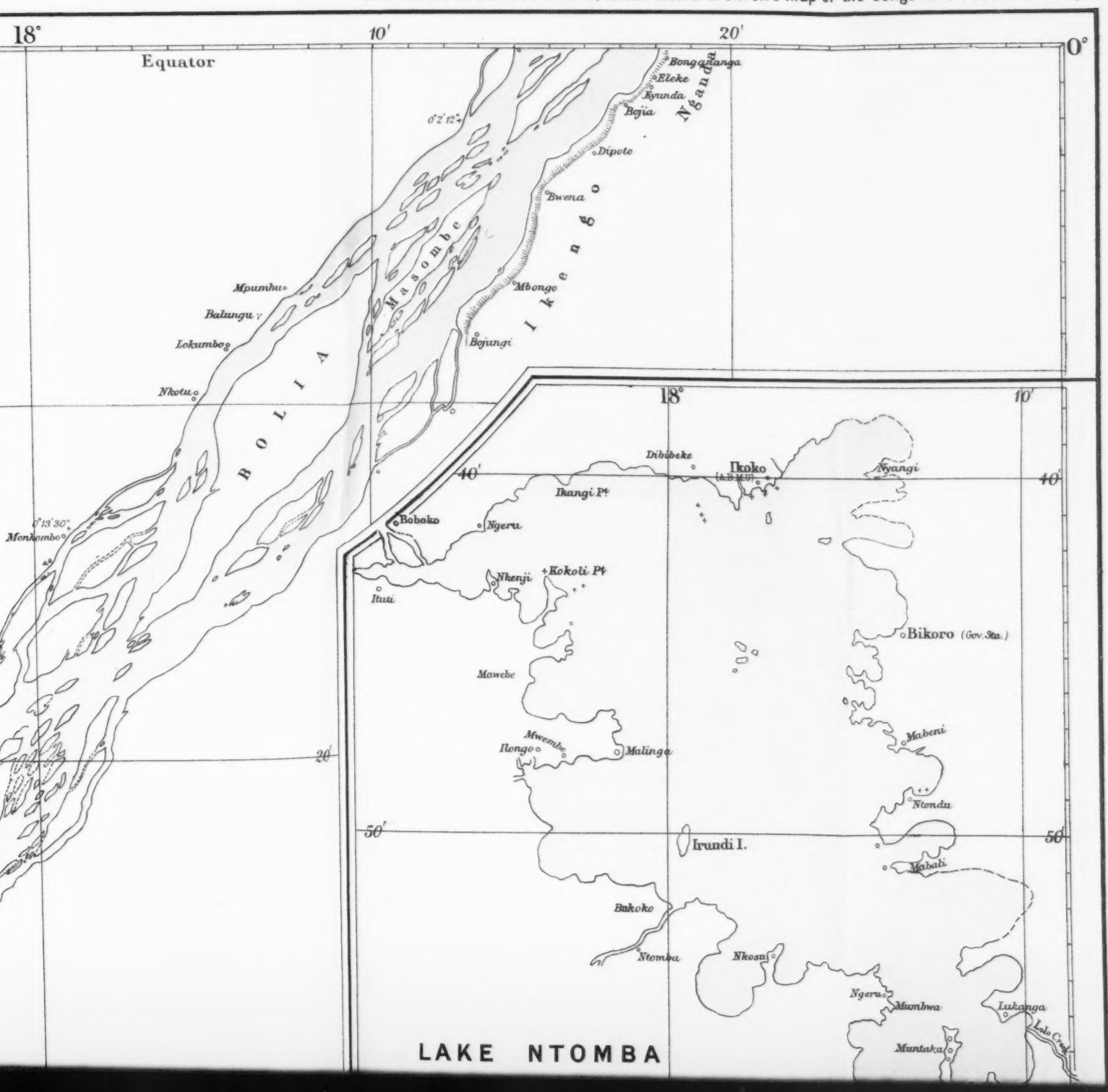
B.M.S. = Baptist Missionary Society. A.B.M.U. = American Baptist Missionary Union. C.B.M. = Congo Balobo Mission. R.C. = Roman Catholic Mission.

20'

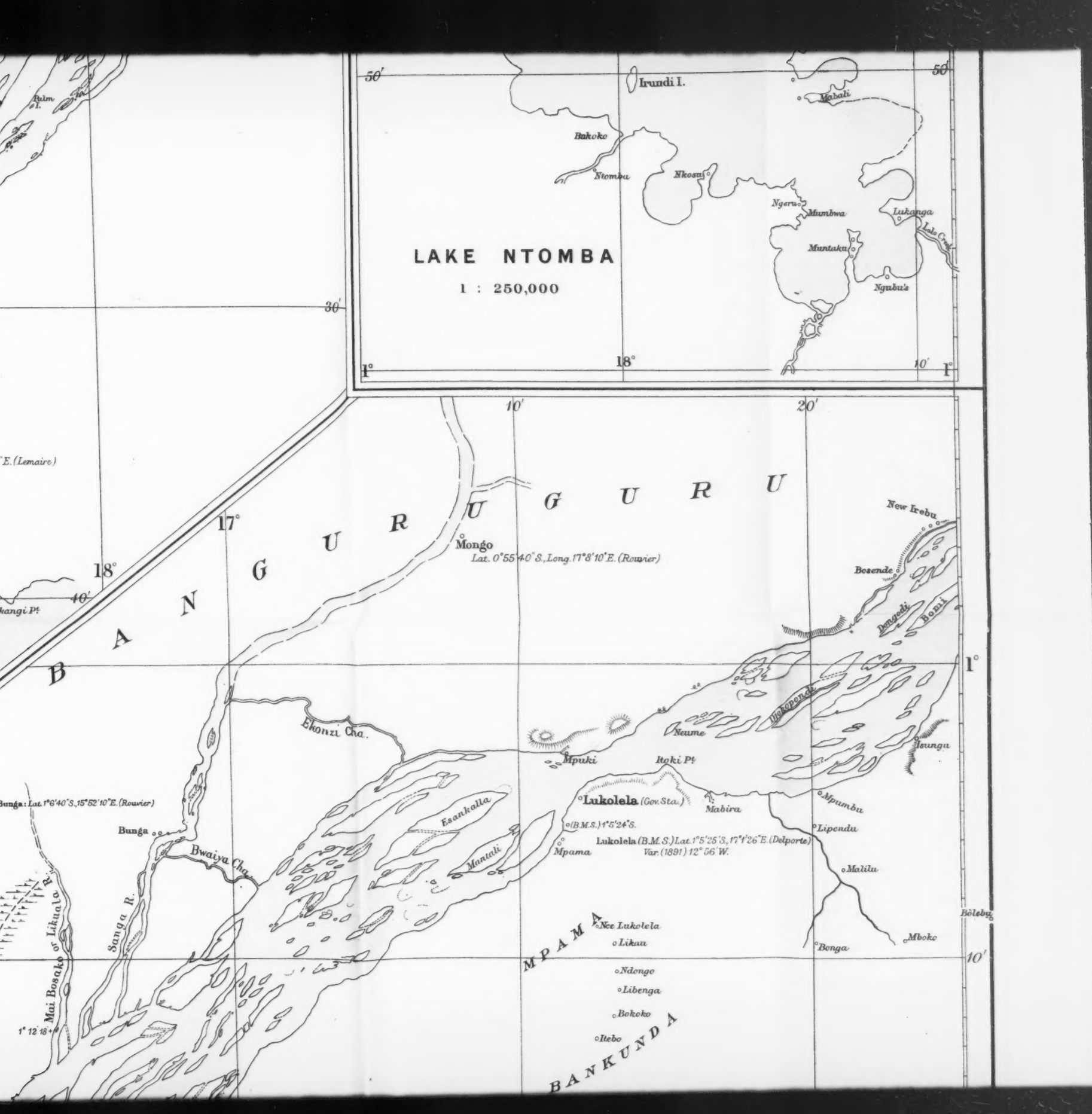
16° 10' 20'

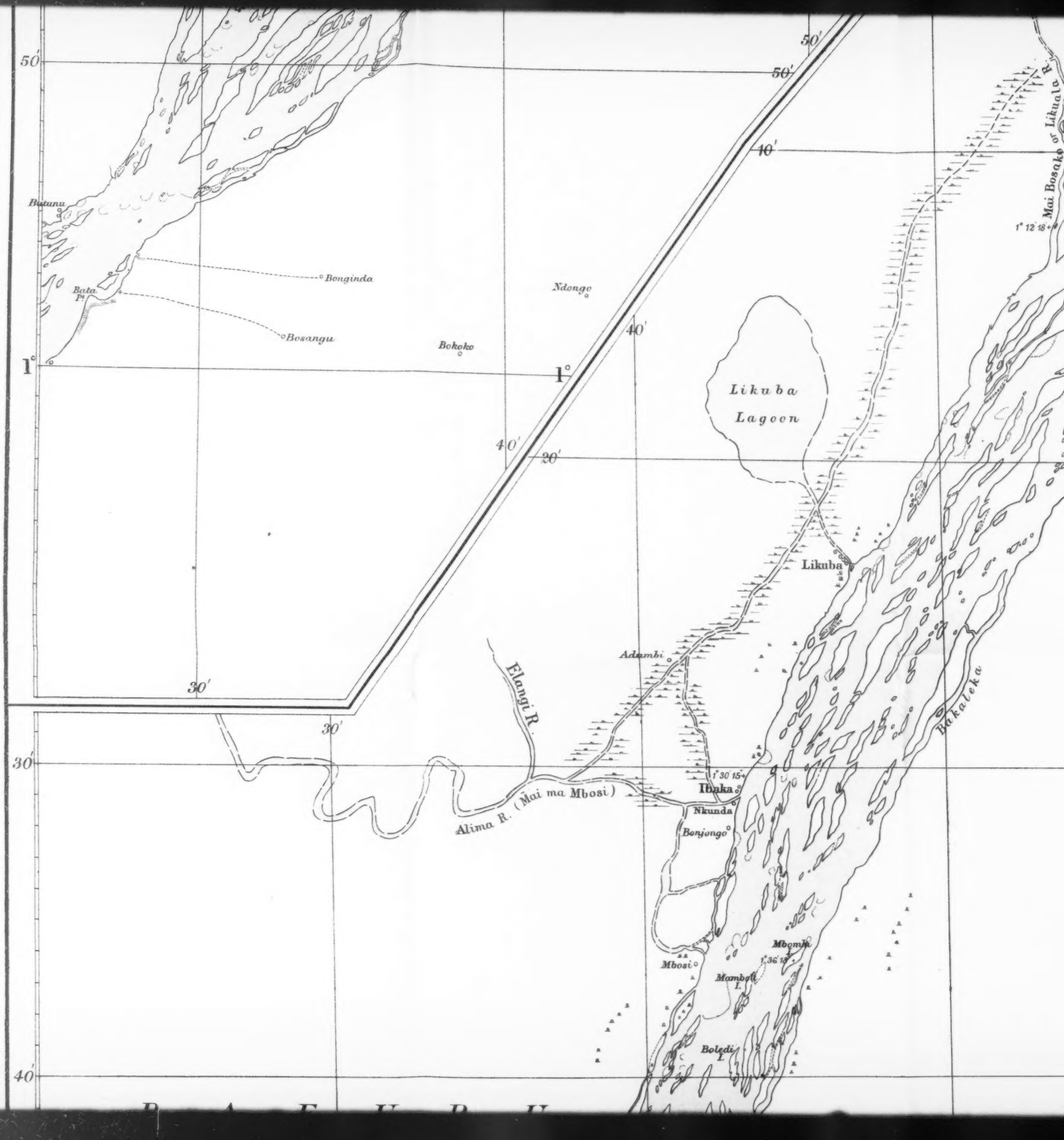
George Philip & Son Ltd, The London Geographical Institute.

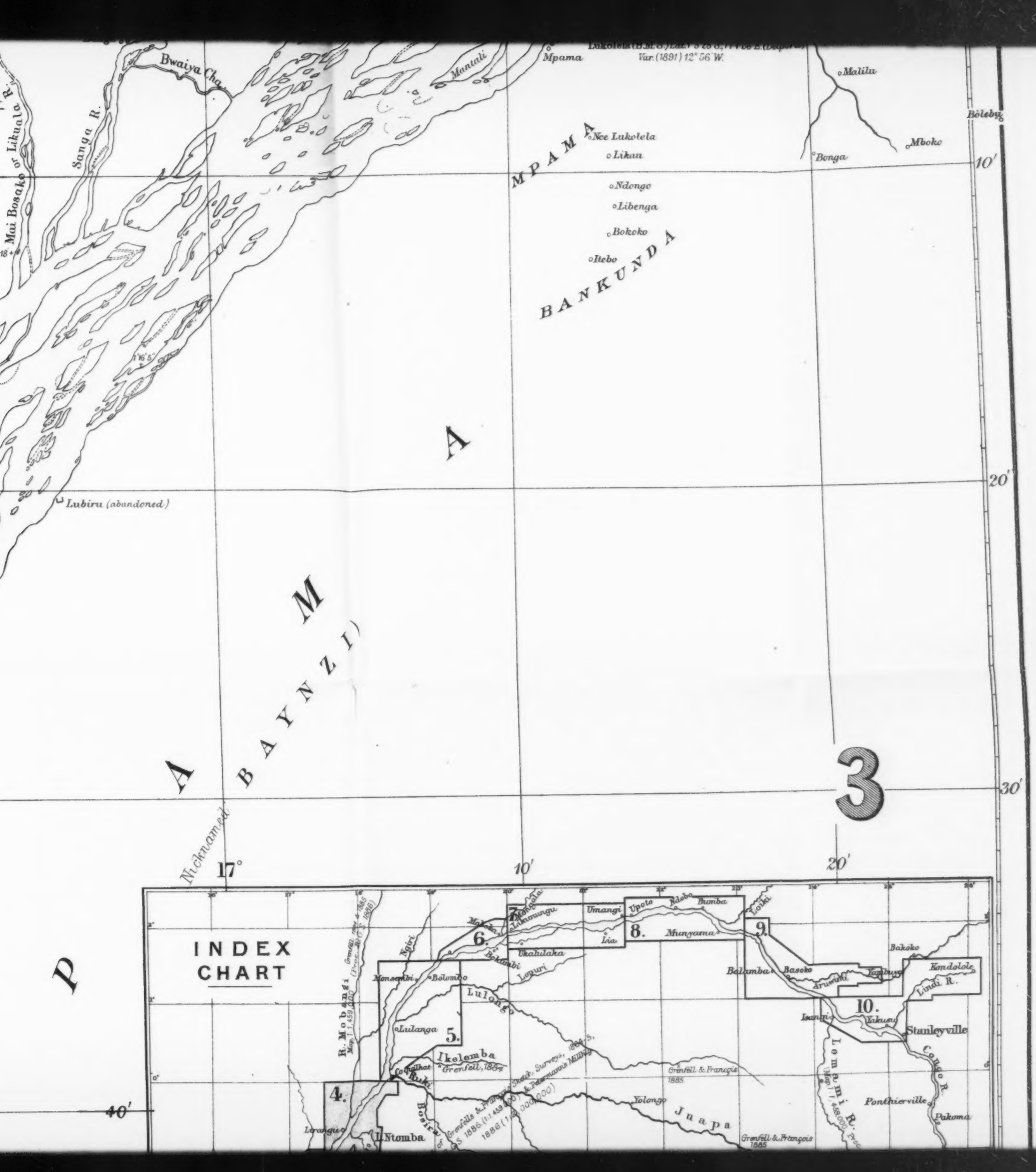

4
Scale — 1 : 250,000
0 5 10 15 20 25 Kilometers
0 5 10 15 Geographical or Sea Miles
0 5 10 15 Statute Miles
0°
30′
40′
50′
10′
20′
Ibunzi
Nkundja
Bompondo
MOBANGI R.
Ekoio
Djundu
Ibenga Cha
I B A T A
Palm I.
BALOI
0° 28′ 0″ S


18°
10'
20'
0°
Equator
Bongalanga
Eleke
Eyunda
Bojia
Ngaula
0°2'12"
Dipoto
Bwena
Mpumbu
Balungu
Lokumbo
Nkotu
Mbongo
Bojungi
Masombe
Ikenao
BOLIA
18°
10'
Dibubeke
Ikoko
(A.B.M.S.)
Nyangi
40'
Ikangi Pt
Boboko
Ngeru
0°13'30"
Monkombo
Nkenji
Kokoli Pt
Ituti
Bikoro (Gov. Sta.)
Mawebe
Mwembe
Ilongo
Malinga
Mabeni
Ntondu
20'
50'
Irundi I.
Mabali
Bakoko
Ntomba
Nkosu
Ngeru
Mumbwa
Lukanga
Lolo Creek
Muntaka
LAKE NTOMBA

BALOI
R.
Djundu
Ibenga Cha
I B A T A
0°28'0"S.
30'
0°33'20"S.
Irebu: Lat. 0°36'41"S., Long. 17°48'4"E. (L
Lwaka
Irebu
(Gov. Sta.)
Liranga
R.C.
Busindi
Bokaka
40'
Koko
Ikangi
Ngeru
0°42'27"
Ngombe (Gov. Post.)
L. NTOMBA
Nkenji
Ituti
30'
Bunga
0°47'45"S.
50'
50'
40'
Butunu
Bonginda
Bata
Ndongo
1° 12


LAKE NTOMBA
1 : 250,000
Irundi I.
Mabali
Bakoko
Ntomba
Nkosi
Ngeru
Mumbwa
Lukanga
Lake Creek
Muntaka
Ngabui's
50'
1°
18°
10'
1°
30'
10'
20'
17°
18°
40'
1°
B A N G U R U
G U R U U
Mongo
Lat. 0°55'40" S., Long. 17°8'10" E. (Rouvier)
New Irebu
Bosende
Bongedi
Bomi
Ekonzi Cha.
Mpuki
Itoki Pt
Neume
Ujokopondo
Isungu
Lukolela (Gov. Sta.)
(B.M.S.) 1°5'24" S.
Lukolela (B.M.S.) Lat. 1°5'25" S., 17°1'26" E. (Delporte)
Var. (1891) 12° 56' W.
Mabira
Mpumbu
Lipendu
Malilu
Mpama
Esankalla
Mantali
Bwaiya Cha.
Bunga
Bunga: Lat. 1°6'40" S., 15°52'10" E. (Rouvier)
Sanga R.
Mai Bosako or Likuala R.
1° 12' 18"
Nee Lukolela
Likaa
Ndongo
Libenga
Bokoko
Itebo
MPAMA
BANKUNDA
Bonga
Mboko
Bôlebu
10'
Kangi Pt
E. (Lemaire)


50'
50'
40'
Butunu
Bonginda
Bata Pt.
Bosangu
Ndongo
Bokoko
1°
1°
40'
20'
Likuba Lagoon
Likuba
Adambi
Elangi R.
30'
30'
Bakaleka
Mai Bosako or Likuala R.
1° 12' 18"
1° 30' 15"
Ibaka
Nkunda
Bonjongo
Alima R. (Mai ma Mbosi)
Mbomb
1° 36' 18"
Mbosi
Mamboli I.
Boledi I.
40'


Bwaiya Cha
Sanga R.
Mai Bosako or Likuala R.
Mantali
Mpama
Var. (1891) 12° 56' W.
Malilu
Bôlebu
Nce Lukolela
Likaa
Mboko
Bonga
MPAMA
Ndongo
Libenga
Bokoko
Itebo
BANKUNDA
Lubiru (abandoned)
A
M
BAYNZI
A
P
Nkoknamed
17°
10'
20'
30'
40'
3
INDEX CHART
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
Ikelemba
Grenfell, 1884
Lulanga
Ntomba
Mobangi
Ngiri
Bolombo
Mansembi
Lopuri
Ukalulaka
Bokumbi
Lia
Mungama
Upoto
Umangi
Ndaba
Bumba
Loiki
Bakoko
Bolumba
Basoko
Aruwimi
Yambuya
Kondolole
Lindi R.
Isangi
Yakusu
Stanleyville
Congo R.
Lomami R.
Ponthierville
Pakama
Yolongo
Juapa
Grenfell & François 1885
Grenfell & Francois 1885
Grenfell, Chart 4 1885 (1886)
Grenfell & Francois Road Surveys, 1885
Grenfell & Adamson's Milling
Grenfells & Francois of S. 1886 (1:459,000)
1886 (1:459,000)

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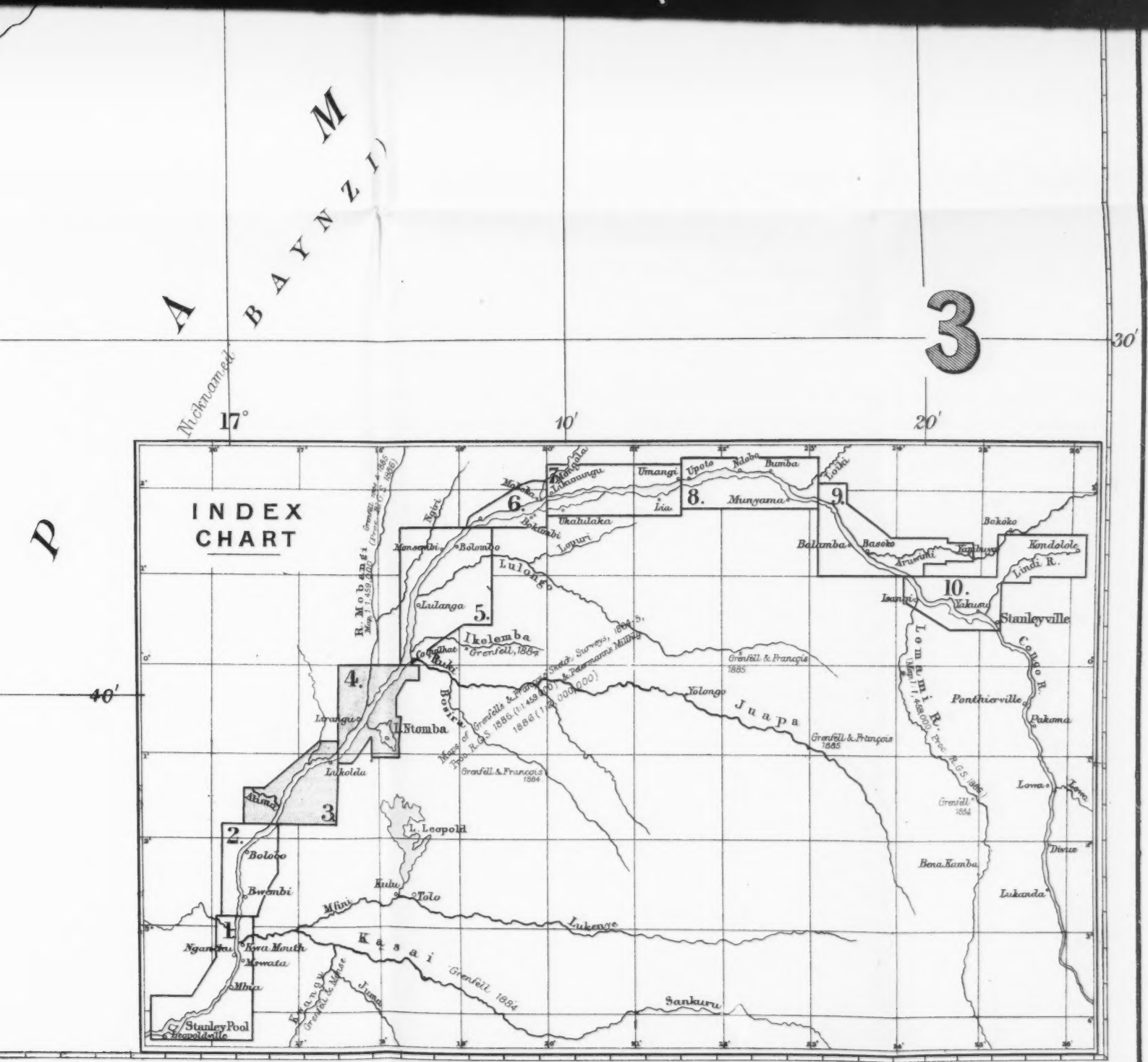

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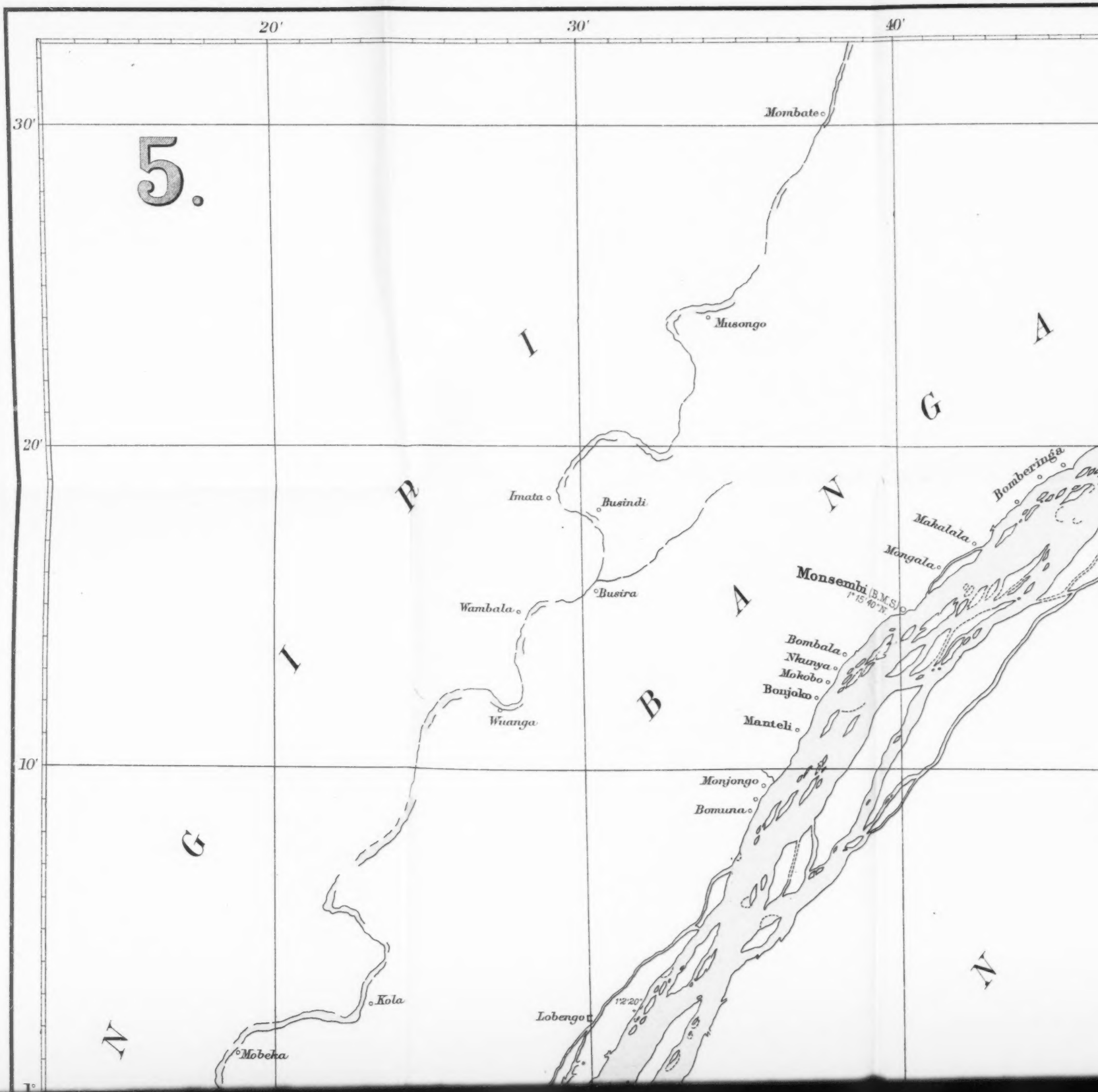
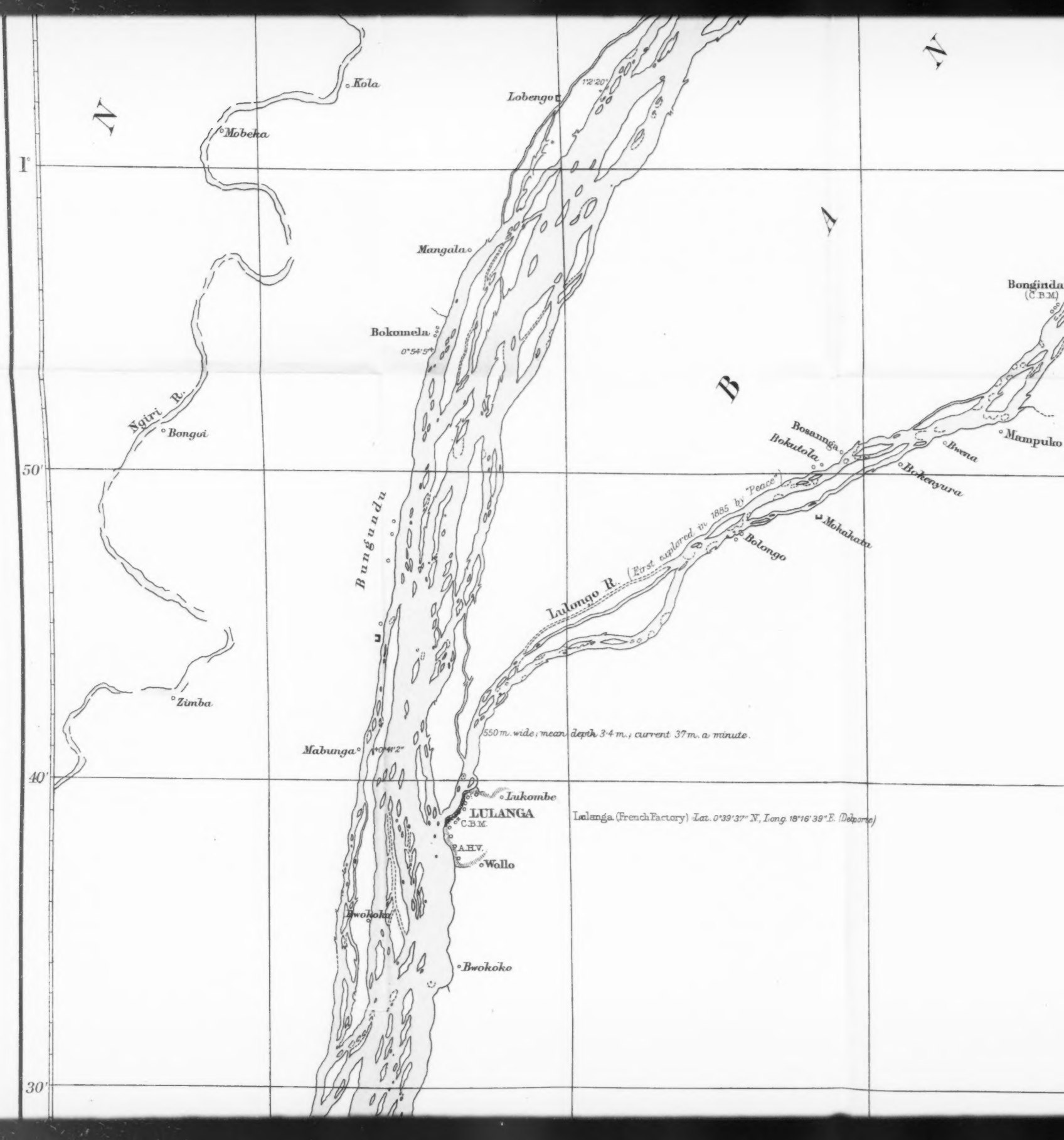
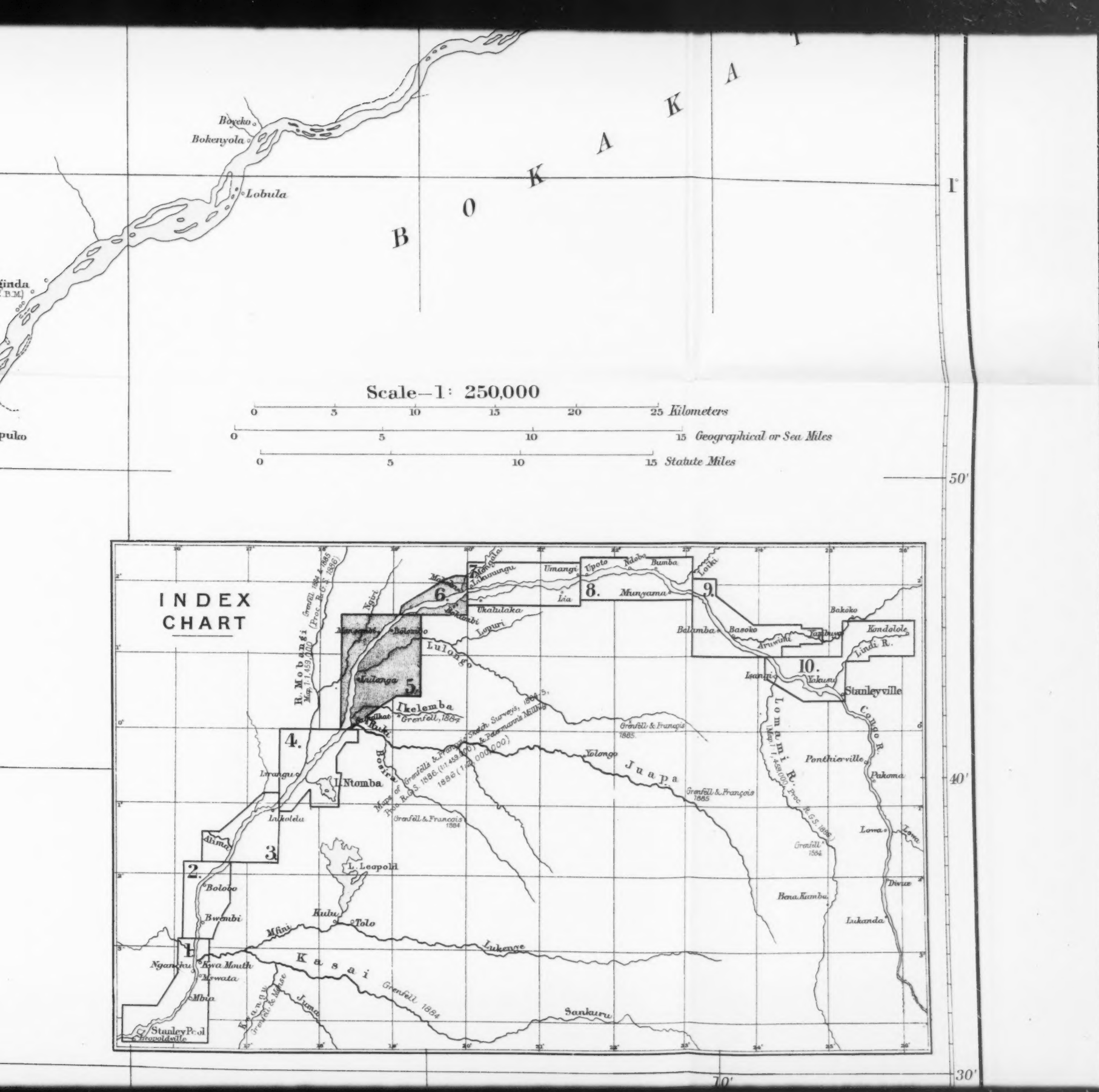
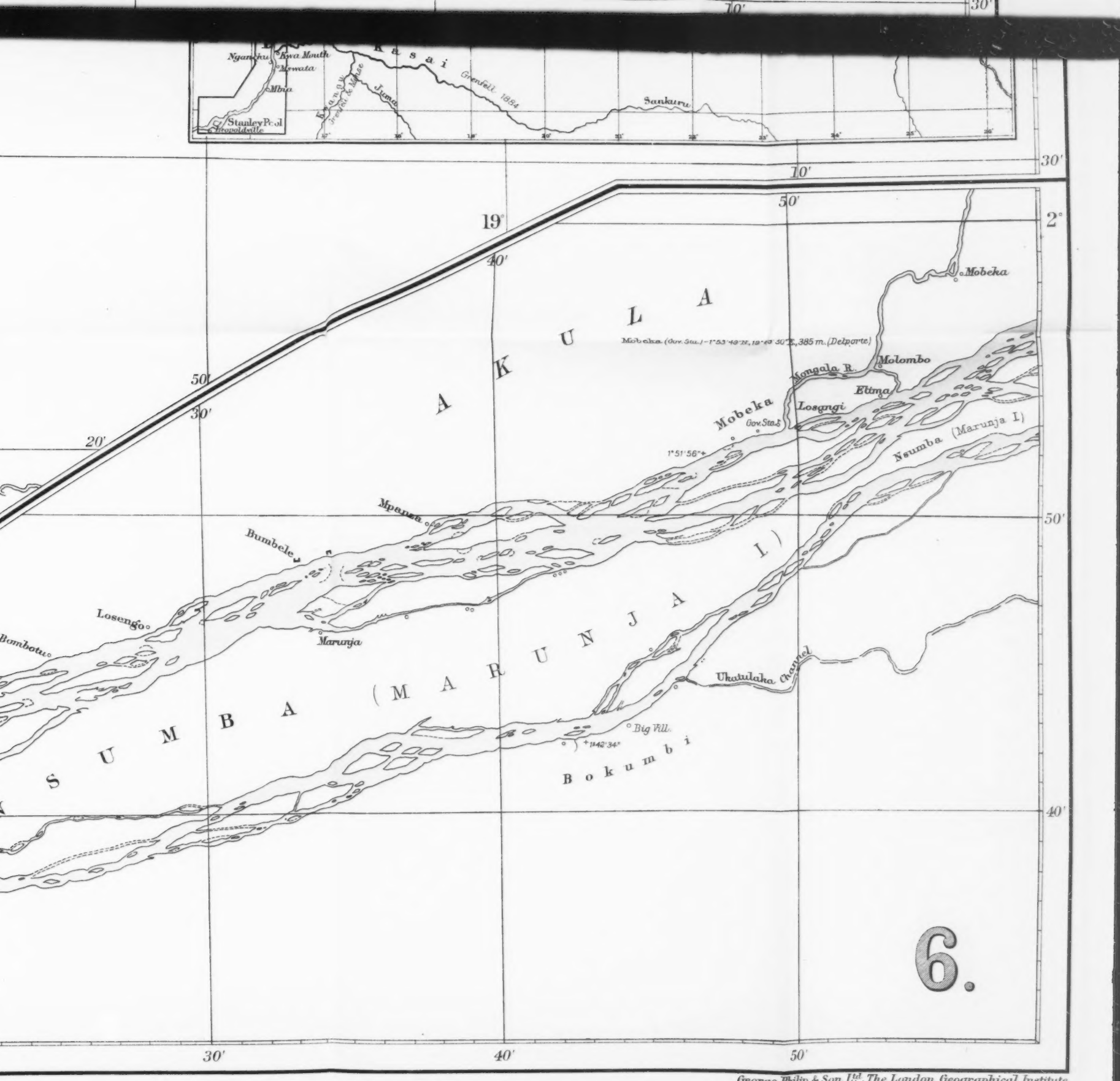

5.
20'
30'
40'
30'
20'
10'
1°
Mombate
Musongo
Imata
Busindi
Busira
Wambala
Wuanga
Kola
Mobeka
Lobengo
Bomberinga
Makalala
Mongala
Monsembi (B.M.S.)
1° 15' 40" N.
Bombala
Nkanya
Mokobo
Bonjoko
Manteli
Monjongo
Bomuna
12'20"
I
P
U
G
A
B
A
N
G
I
N

50'
19°
10'
30'
20'
10'
Bobuka
Libululu
Monkongola
Lobengo
Bolombo
NGOMBI
Bolombo
Wamballa [Mwambala]
Boyeko
Bokenyola


Kola
Lobengo
1°2'20"
Mobeka
1°
Mangala
Bonginda
(C.B.M.)
Bokomela
0°54'5"
Ngiri R.
Bongoi
B A N
Bosanga
Bokutola
Mampuko
Bwena
Bokenzura
50'
(First explored in 1885 by "Peace")
Mokaka
Bolongo
Bungundu
Lulanga R.
Zimba
550 m. wide; mean depth 3·4 m.; current 37 m. a minute.
Mabunga
1°0'4"2"
40'
Lukombe
LULANGA
C.B.M.
P.A.H.V.
Wollo
Lulanga. (French Factory) Lat. 0°39'37" N, Long. 18°16'39" E. (Delporte)
Bwokoka
Bwokoko
30'


B O K A K A
B O K A K A
Boyeko
Bokenyola
Lobula
Scale—1: 250,000
0 5 10 15 20 25 Kilometers
0 5 10 15 Geographical or Sea Miles
0 5 10 15 Statute Miles
1°
50'
40'
30'
INDEX CHART
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
Ikelemba
Grenfell, 1887
L. Ntomba
L. Leopold
Stanley Pool
Stanleyville
Ponthierville
Lomami R.
Congo R.
Kasai
Juapa
Lukenge
Sankuru
Yolongo
Lulonga
R. Mobangi
Grenfell & Francois 1885
Grenfell & François 1885
Grenfell & Francois 1884
Grenfell, 1884
Grenfell 1884
Grenfell & Mace
Grenfell & Hawker 1885
Grenfell & Hawker 1886
Grenfell & Hawker 1888
Grenfell & Parminter 1888
Grenfell & Parminter 1889
Grenfell & Parminter 1890
Grenfell & Parminter 1891
Grenfell & Parminter 1892
Grenfell & Parminter 1893
Grenfell & Parminter 1894
Grenfell & Parminter 1895
Grenfell & Parminter 1896
Grenfell & Parminter 1897
Grenfell & Parminter

Bwokoko
30'
Ebila (a tree)
26°15" N.
Mobao
To Mobangi
Bungata
20'
Ikenza
M B I .
O
G
N
E. Ngombi
Ch. Dimanu
Itedi
Mikunga
40'
20'
W. Ngombi
Bolenge
Entumba
Bomb
A
L
A
Munkoi (a tree)
10'
Bokangi
10'
30'
Bakanga
Monyondu
Nsamballa
Ikelemba R.
G
N
Coquilhatville: Lat. 0°4'0"N, Long. 18°18'20"E. (Lemaire)
Equateur: Lat. 0°2'0"N. 18°13'10"E. (Rouvier)
Lat. 0°1'52"N., 18°16'19"E. (Lemaire)
Var. (1886) 2°50' W.
Ikulangu
Pillar Tree
Wamballa
Matunda
Ikuba
Ituki or Juapa
Yambo
Mandaka
Nouvelle Anvers
(Bangala, R.C.)
Bobunga
Coquilhatville (Gov. Sta.)
Borombi
Bomgi
Bandu
Ekambele
Balogwasamba
Wangata
S.A.B. (Equateur)
Bakanga
(Ch. Likomois)
Tipanza
Bokuru
Bokuru Ndobo
Ndondu
Bolenga (A.B.M.U.)
Ngiandu
0°
18° 20'
19° 10'
20'



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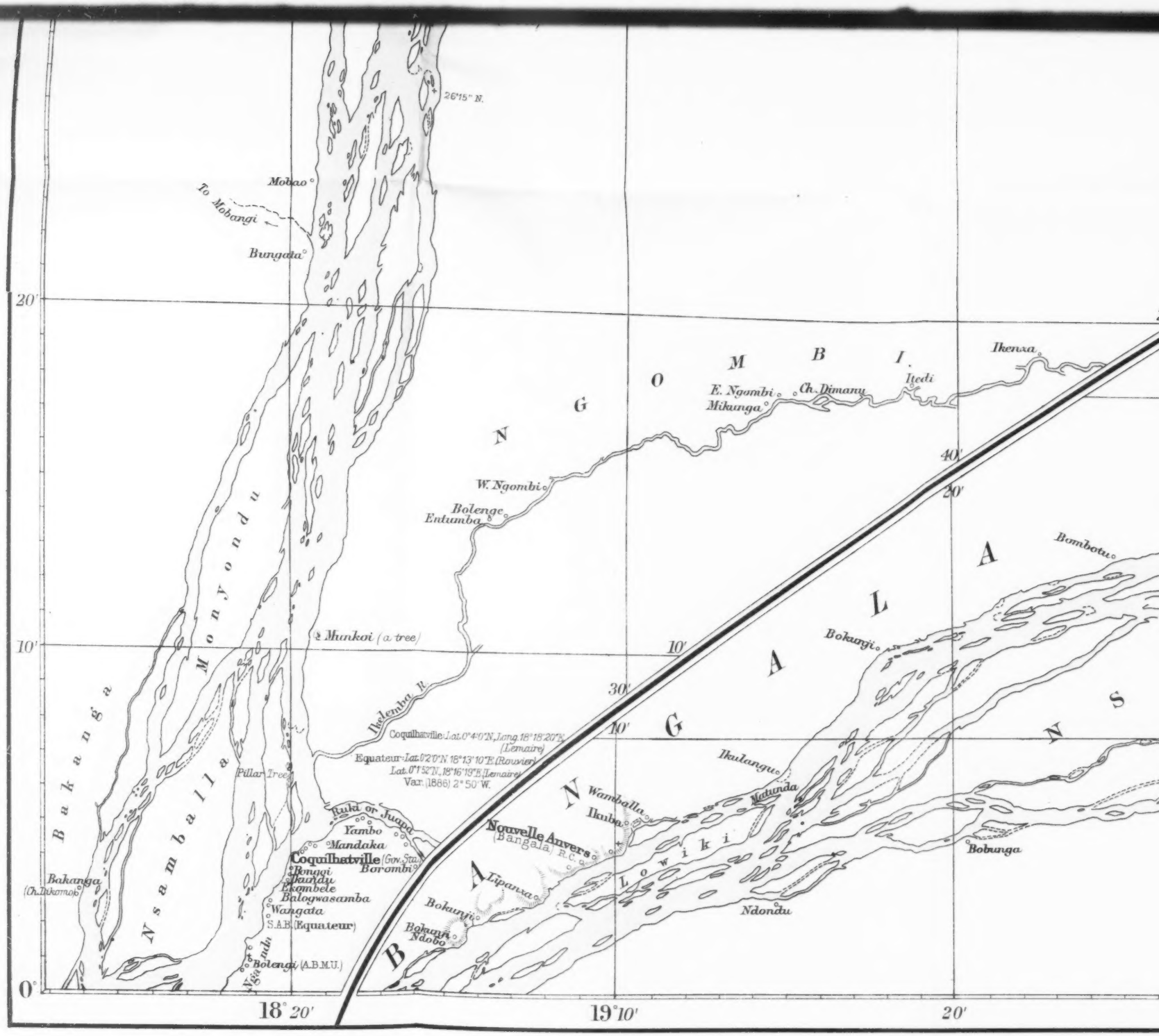

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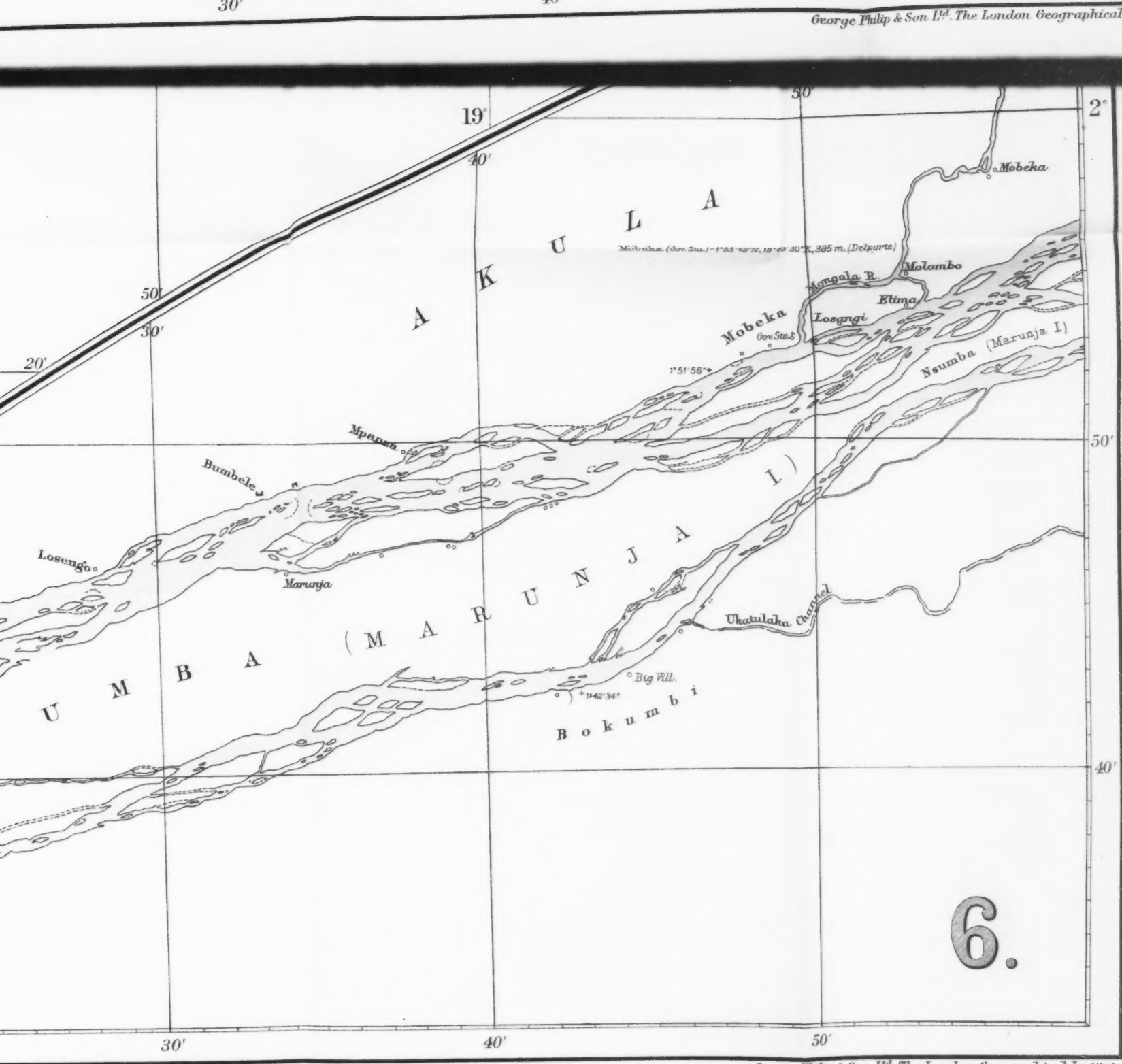

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